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VOL LVI 17 MAY 1947 No 1453

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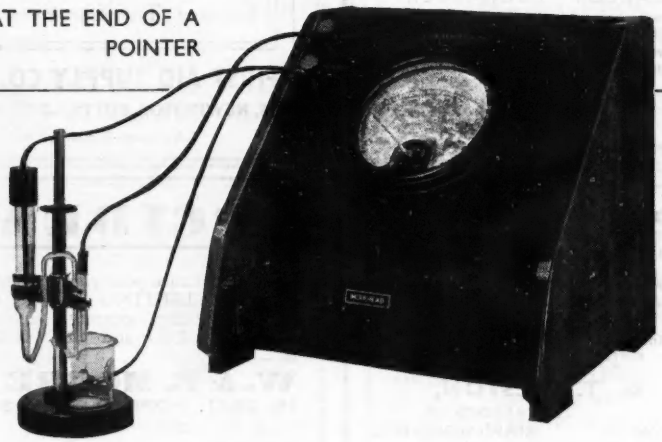

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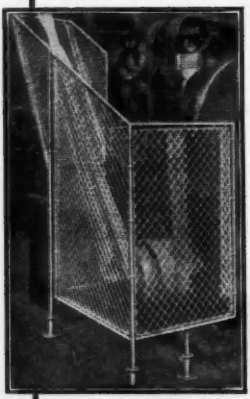

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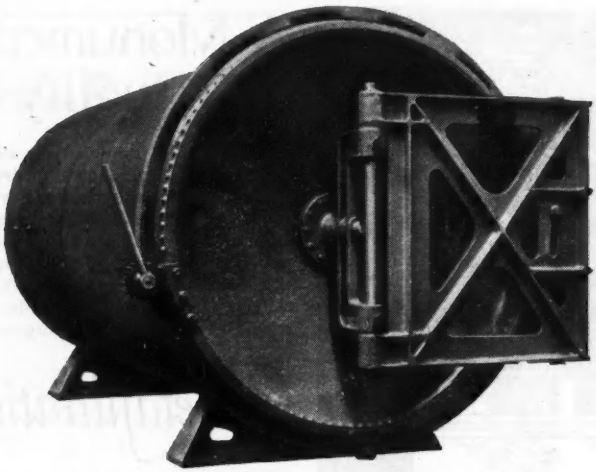

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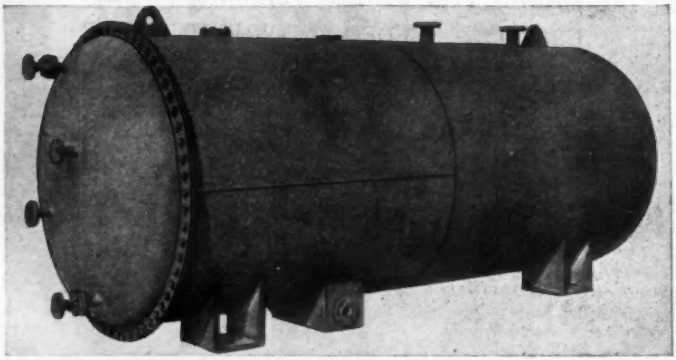

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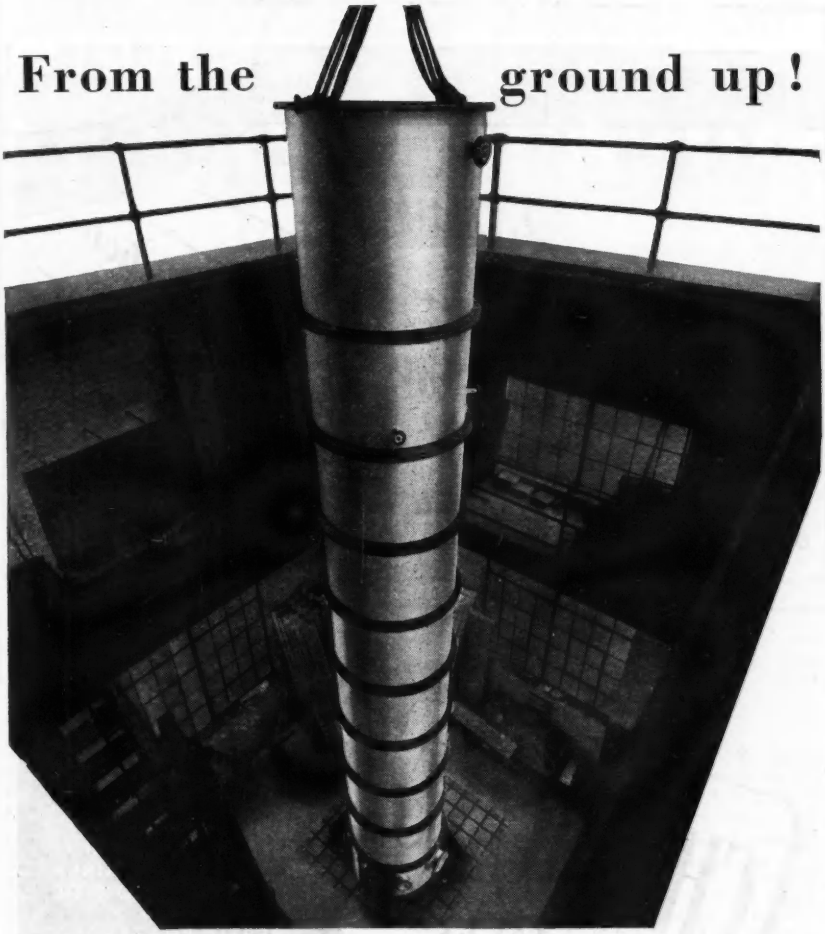

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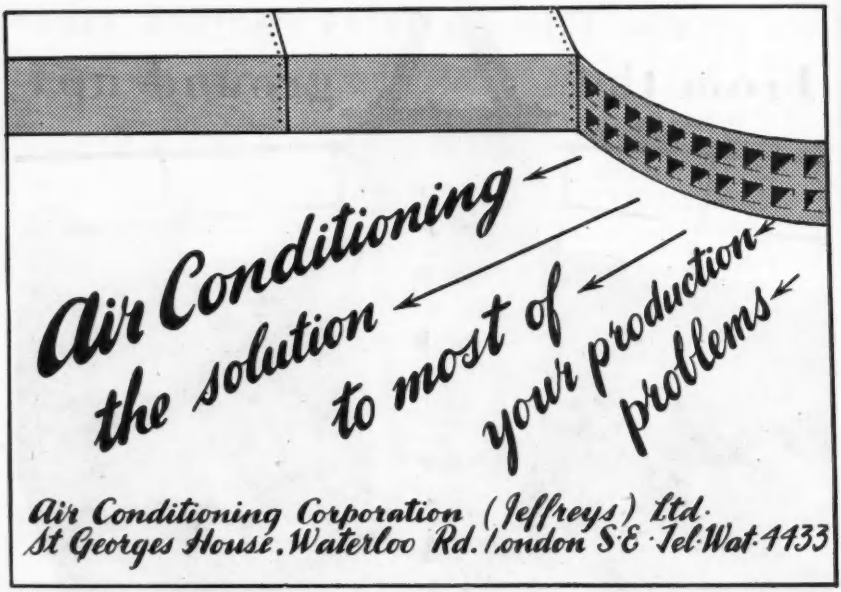
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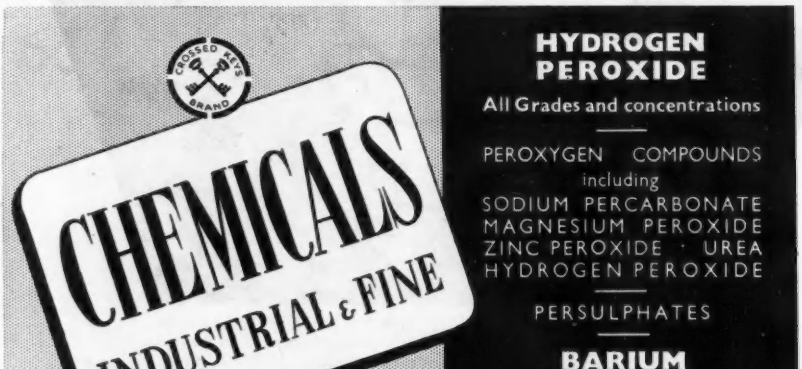
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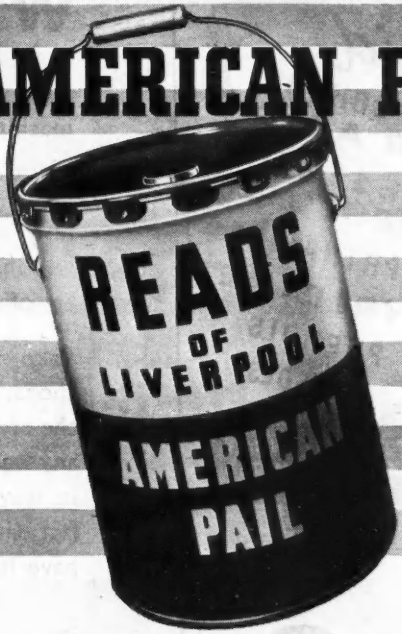

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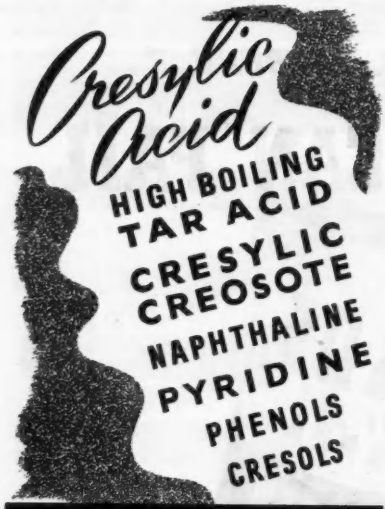

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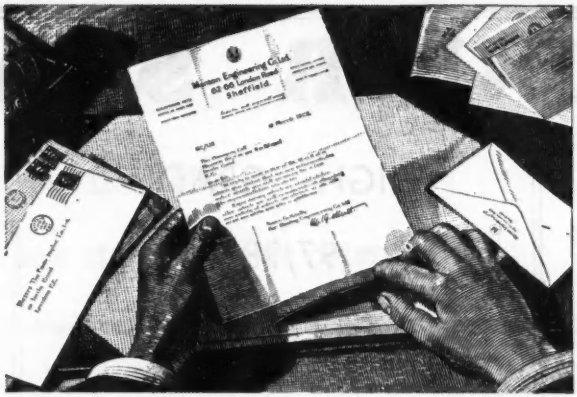

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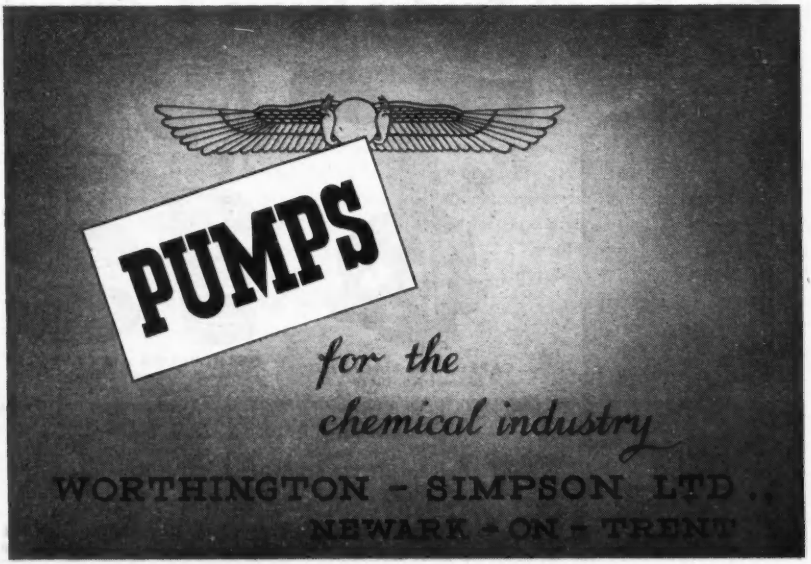

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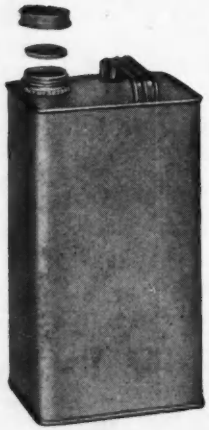
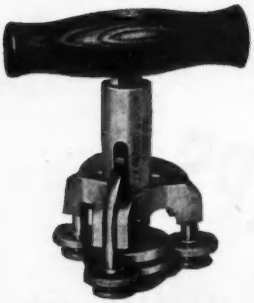


Square can showing patent screw neck.
Patent No. 382,380



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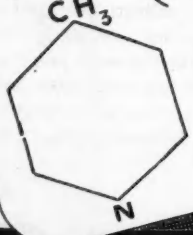

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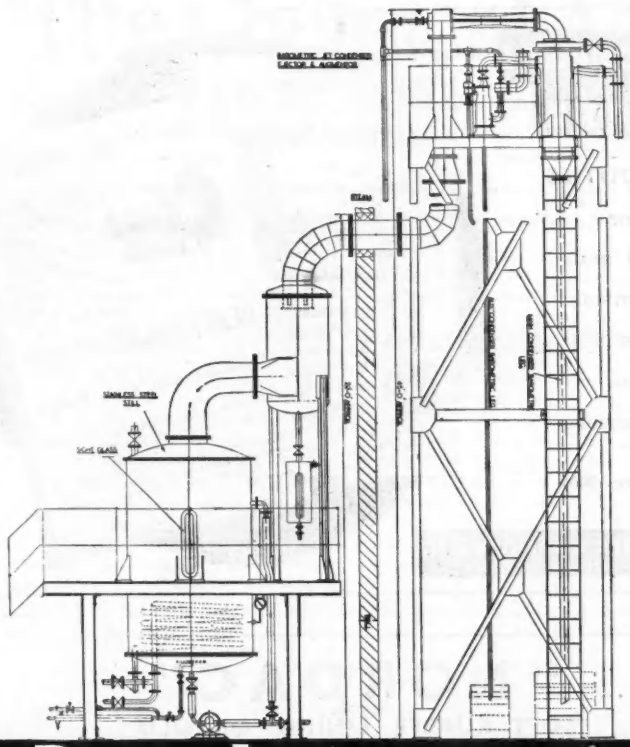

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Research Organisation

ALL business operations involve the taking of decisions based on probabilities rather than on certainties. Many of the greatest fortunes have been made through good judgment, which means nothing more than the correct solution of the problem of probability applied to business affairs. These solutions have generally been made by those without scientific or mathematical knowledge and are correctly and expressively described in modern parlance by the word "hunch." "Hunches" are all very well when applied by a gifted individual responsible only to himself. In modern business something more definite is needed upon which the probabilities of a situation can be weighed up. It is the function of the higher technical staff to provide that more definite guidance which is so necessary.

The chairman's address to the Road and Building Materials Group of the Society of Chemical Industry entitled " Research in the Balance Sheet " which has lately been published, raises certain questions as to the best organisation of the technical staff in order to secure the guidance that is necessary. It may be remembered that Sir Harold Hartley some years ago in a booklet published by the Federation of British Industries urged that every firm should have on its staff at least one individual capable of interpreting published technical information to his less technical colleagues; in other words there should be a technical man responsible for watching technical developments and for seeing that whatever technical developments could be applied to the business of his firm were applied to the fullest possible extent. It is the custom abroad that the chief technical executive should be a member of the board. In this arrangement it is evident that he is on the board not only to guide the board's deliberations on the technical side but to explain to his non-scientific colleagues the significance of technical matters. The best technical director would need to have a special gift for lucid explanation. In the scientific sense he must learn to suffer fools gladly knowing that while he himself has special knowledge of particular subjects his colleagues who are quite ignorant of those subjects have for their part special knowledge of other subjects, of which he is equally ignorant.

This arrangement appears to work very well, particularly when the technical director has the necessary qualifications to act as a channel of communication between the technical staff and the commercial management. It seems, however, to be a practice which is very much less prevalent in this country where the technical and scientific man is generally regarded as a " back room boy " who must not be allowed to meddle with practical affairs other than to see that the wheels keep going round. This fact appears to carry with it the suggestion that the proper rôle of the chief technical executive is not fully understood in this country. He is regarded as the man who operates the factory, but his second function, that of assisting in solving the probability equation of business through the medium of precise facts does not seem to be recognised as it should be. Mr. L. G. Gabriel in giving the address to which we have referred points out that the value of the technically-trained man in business is that he conducts his business largely as a result of logical reasoning whereas the non-scientific

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man is more swayed by the emotions. Nevertheless, every man should be in his right place and it is certainly true that in some fields such as that of the management of labour, the man who is swayed by the emotions and who approaches his problem from that aspect is more likely to be successful than those who are swayed by nothing but the cold light of reasoning.

In all this there may well be the reason why many scientific men do not succeed in business or in the handling of their fellows. The capabilities and limitations of the purely scientific outlook must both be correctly assessed if the best use is to be made of their particular qualities.

It thus appears that the technical staff engaged in plant operation may be different in function and in personnel from that concerned with the general technical direction of the business, which latter includes that of being the channel of communication between the technical staff and the commercial management. Those engaged in plant operation have generally quite enough to occupy their time without trying to keep abreast of all the new ideas that are stirring and applying them to their business. Clearly, therefore, the man who does the long-range planning, the man who keeps most in touch with current thought and its applications, the man who advises the board, must be something of a specialist and, whether organised research is conducted or not, he must be in a very real sense a director of a research department. That research department may be extensive or it may consist of no one but himself.

Granted, therefore, that every firm that is engaged in any branch of scientific or technical manufacture should have a research department, the question arises as to how that department should be organised. Should it be a separate department or should it be a section of a general technical department. The answer to this conundrum must obviously depend upon the character of the business concerned. If a firm is sufficiently large there can be and there should be a separate research department. If a firm is smaller it is more usual for the same staff to undertake a dual function unless there is so much routine work to be done that the research function of the department is seriously handicapped by its routine duties.

There are many subjects connected with the organisation of a research department on which we could dilate following upon Mr. Gabriel's excellent analysis. How far, for example, should fundamental research be pursued in a works research organisation? There are many different answers to that question, depending upon the character of the work, size of the laboratory and the ability to take long views of the possibilities of investigations which on the surface appear to be entirely academic. Under what conditions should research be conducted and how thorough should be the control over the research staff? How far should the pilot plant be developed before commercial exploitation is attempted?

We do not propose to answer any of these questions other than to point out that when a new process has been developed to the pilot plant stage and it is turned over to the operational staff, they may regard the research staff as something of a nuisance in that the latter are putting forward new ideas, new duties and new methods, all of which may prove a serious headache to the production team. The technical director must at all costs succeed in establish-

ing ideal relations with the production team. There is little doubt that all these considerations lead to the conclusion that few firms today can afford to be without at least one technical man on their staff who has the vision to apply published knowledge to the operations of his concern. These applications are not only those of day-to-day operation as is generally supposed, but they go a good deal further than this in that they are intimately concerned with the taking of decisions based on probabilities which can be brought nearer to certainties in proportion to the degree to which they are subjected to scientific analysis. A good technical man on the board of directors with the ability to explain technical and scientific matters to his colleagues, can be of the greatest value in the direction of any business.

NOTES AND COMMENTS

I.G. Farben

NEWS was released last week of the impending trial before an American military tribunal of the directors of I.G. Farben Industrie. No less than 24 directors and executive officials have been indicted. They are charged with preparing and waging wars of aggression and with other more specific crimes. That the operations of the I.G. Farben were inimical to the interests of Great Britain was apparent long before the war. What was not so apparent then were the world-wide ramifications of this German colossus and the restrictive covenants it placed on subsidiary foreign companies. During the war we discovered how restrictive these covenants could be, and the direct help they could give the German military machine. Evidence given before a Committee of the American Senate was the first real light to be shed on this German combine. The evidence showed the subservience of several American companies, nominally controlled by American citizens, to I.G. Farben. In some cases the German concern set up its own subsidiary companies under the control of naturalised Americans. (Hitler it will be recalled promised Germans who became citizens of other countries in order to help the Reich, that they would still be looked on as Germans and enjoy all their rights—presumably after conquest of their naturalised country.)

Is it Dead ?

SO cleverly had I.G. Farben worked that when the blockade was enforced at the beginning of the war their South American and other foreign subsidiaries were able to operate without any financial or material help from their parent company. In fact much needed foreign exchange was provided Germany by these companies, while the Allies were completely helpless in face of the operations of these companies which were apparently owned by nationals of the various countries and could not therefore be touched. In evidence before the American Senate it was admitted by I.G. Farben officials that they had not attempted to invade the British chemicals market : but their tentacles had penetrated nearly every other country of importance. It is impossible even now for the American Government completely to unravel the deliberate tangle of subsidiary companies, leased patents and the many devices used by I.G. Farben to help cover their tracks. Because of the great international influence of I.G. Farben many people thought that their directors would never be brought to book. They are, however, to stand in the dock. But behind them there is still the ominous shadow of this giant concern. Informed people will ask : " Has the heart really been taken from the terrible octopus? Will not the thousand and one tentacles in a dozen foreign countries remain alive, and in time join up again within or without Germany?"

Industrial Charter

IN the precarious situation prevailing in home production and international commercial affairs in which this country finds itself after two years of Socialist administration, " The Industrial Charter " issued this week by the Conservative and Unionist Central Office is likely to command more respectful attention than a publication issued by any non-governing political party has done before. The need for prompt action to clear away the jungle of impediments, which has grown up around industry, before an insufficiency of export goods and of foreign currency forces a disastrous reduction of raw materials and of foodstuffs, is now widely recognised throughout the country. The confidence with which the Government comparatively recently undertook to create near-Utopian conditions for

almost all is now conspicuously lacking after the series of preventable " crises " which have taken their toll of industry and the individual. They and the electorate have had a painful lesson, which even now is probably not complete. The middle of 1948 is now being mentioned authoritatively as " zero-hour."

The Conservate Plan

THE immediate attractiveness of " The Industrial Charter," drawn up by a committee and carrying the full authority of the Conservative party, is that, unlike election pledges, it deals in plain terms with specific problems of urgent importance without invoking party shibboleths to confuse the issue. It is concerned only with facts and gives a factual exposition of how a Conservative administration will deal with them. The statement comprises three parts, the first describing the immediate action which should be taken in dealing with the present crisis, the second defines the relationship which a Conservative Government would establish with industry, and the third sets out " a charter of rights and duties " for the worker in industry. The last is framed with full recognition of the fundamental importance of the worker and the intention of making his participation fuller and giving him the proper reward of extra effort. The programme set out for industry and the country as a whole proposes the ending of all further nationalisation and any other kind of monopoly and the submitting of nationalised industries, excepting the coal industry and the Bank of England, to a rigorous examination to assess their efficiency under the new conditions. The detailed plan for industry may be broadly summarised as releasing the producer from irksome and ineffective controls, while retaining all those required to secure fair distribution, and providing the fullest incentives at all stages to exploit individual initiative and secure that full production which recent legislation has so conspicuously failed to do.

Harold: ***When does he get tired, mister ?***
Keeper: ***Why ?***
Harold: ***Well, old Peptic says you can get silver from exhausted hypos !***

Ill Rewarded Enterprise

THE story of limitations within which key industries have been confined for the better part of a year recalls the nursery jingle about the House that Jack Built. Shipbuilders have called a meeting in London to decide what can be done to convince the Government that unless the inadequate allocations of steel to their yards are increased there will very soon be serious unemployment on the Clyde, Tyne and elsewhere; the steel is rationed because the steelworks cannot get the coal to maintain even 75 per cent of the output of which they are easily capable. Why they and a dozen other essential productive activities, such as heavy chemicals, are still starved of coal is one of the couplets in the narrative better not recited at the moment. Since there is manifestly not nearly enough coal to go round the need for intelligent distribution is self evident; that this is still not being done is equally evident. From dozens of instances of unintelligent handling take that of the Bradbury Steel Mills at Stockport, where 1800 workers, through their shop stewards, recently sought an interview with the chairman of their Regional Board for Industry and sent a letter to Mr. Herbert Morrison to point out that because one section of them, which by a production drive had just produced more steel than it had ever done before, the mills have now been put on short time—not enough coal. This extremely odd award for good conduct is not unique. The same firm has responded to a Government appeal by preparing a scheme to convert part of the mills to oil burning. Now they have been told their coal allocation will be reduced by 1 ton for every ton of oil used. If the widely accepted estimate that 40 tons of oil are needed in this branch of industry to replace 35 tons of coal yet another incentive to relieve the drain on coal will have received a knock-out blow.

CHEMICAL CONGRESS

PROVISIONAL PROGRAMME FOR LONDON MEETING

THE provisional programme of the XI International Congress of Pure and Applied Chemistry to be held in London from July 17 to 24 is now available. The Congress is being held under the patronage of H.M. the King. The president is Lord Leverhulme and there is a distinguished executive committee under the chairmanship of Dr. L. H. Lampitt, president of the Society of Chemical Industry.

Fourteen sections are holding sessions, one of them being a new one formed at the request of France to discuss chemistry in relation to essential oils, flavouring materials and cosmetics. The sections, with their chairmen, are:

Section 1: Inorganic and Geo-Chemistry.—chairman, Professor H. V. A. Briscoe; secretary, Dr. A. J. E. Welch, Imperial College of Science and Technology, South Kensington, S.W.7. 2: Physical Chemistry—chairman, Professor S. Sugden; secretary, Dr. E. R. Roberts, Imperial College of Science and Technology. 3: Organic Chemistry—chairman, Professor A. R. Todd; secretary, Dr. E. R. H. Jones, Imperial College of Science and Technology. 4: Biochemistry—chairman, Professor A. C. Chibnall; secretary, Professor F. G. Young, Department of Biochemistry, University College, Gower Street, W.C.1. 5: Chemistry in Relation to Agriculture and Applied Botany—chairman, Professor T. Wallace; secretary, Dr. G. W. Scott Blair, the National Institute for Research in Dairying, Shinfield, near Reading. 6: Chemistry in Relation to Applied Zoology and Veterinary Science—chairman, Dr. W. R. Woolridge; secretary, Dr. K. Mellanby, London School of Hygiene and Tropical Medicine, Keppel Street, W.C.1. 7: Chemistry in Relation to Food and Nutrition—chairman, Sir Jack Drummond; secretary, Dr. T. F. Macrae, Glaxo Laboratories, Greenford, Middlesex. 8: Chemistry in Relation to Medicine and Therapeutics—chairman, Dr. C. R. Harington; secretary, Dr. J. Walker, Medical Research Council, National Institute for Medical Research, N.W.3. 9: Chemistry in Relation to Fuel, Power and Transport—chairman, Sir Alfred Egerton; secretary, Dr. C. M. Cawley, Fuel Research Station, Greenwich. 10: Chemistry in Relation to Natural and Artificial Textiles—chairman, Sir Robert Pickard; secretary, Mr. W. A. Dickie, 23, Hanover Square, London, W.1. 11: Chemistry in Relation to Elastomers, Plastics, Glass and Ceramics—chairman, Professor H. Moore; secretaries, Elastomers, Mr. H. C. Baker, Imperial Institute, London, S.W.7; Plastics, Mr. N. T. L. Megson, Ministry of Supply, Shell-Mex, London, W.C.2; Glass and Ceramics, Mr. H. Fry, British Scientific Instrument Research Association, Elmstead Woods, Chislehurst, Kent. 12: Chemistry in Relation to Metals—chairman, Mr. S. Robson; secretary, Mr. W. A. C. Newman, The Royal Mint, London, E.C. 3: Chemical Engineering—chairman, Dr. A. J. V. Underwood; secretary, Mr. M. B. Donald, University College, W.C.1. 14: Chemistry in Relation to Essential Oils, Flavouring Materials and Cosmetics—chairman, Mr. R. K. Allen; secretary, Dr. Wm. Mitchell, Messrs. Stafford Allen & Sons, Ltd., Wharf Road, London, N.1.

The correlation of the meetings of the various sections is being arranged by a committee of section officers under the chairmanship of Sir Jack Drummond. Well over 1000 chemists have already applied for membership of the Congress and it is expected that their number will exceed 2000 from at least 24 different countries.

A considerable social programme has been arranged, tours being organised by a subcommittee under the chairmanship of Dr. Kent Jones, and special events for the ladies, including a fashion parade and shopping parties, by a sub-committee under the chairmanship of Lady Heilbron.

Opening Ceremony

The opening ceremony by the president of the Congress and the closing session, consisting of a lecture by Sir Robert Robinson, president of the Royal Society, will be at the Central Hall, Westminster, and all other sessions at the Imperial College of Science and Technology, South Kensington. The Congress immediately follows the centenary celebrations of the Chemical Society.

The full executive committee is as follows: Sir Wallace A. Akers, Professor G. M. Bennett, Dr. W. H. Brindley, Professor H. V. A. Briscoe, Sir Jack Drummond, Mr. F. P. Dunn, Dr. W. E. Garner, Professor C. S. Gibson, Professor Sir Ian Heilbron, Lady Heilbron, Dr. E. B. Hughes, Dr. L. A. Jordan, Dr. D. W. Kent Jones, Dr. R. Lessing, Dr. D. C. Martin, Dr. H. W. Melville, Mr. E. M. Myers, Mr. J. Davidson Pratt, Professor E. K. Rideal, Sir Robert Robertson, Sir Robert Robinson, Mr. F. H. Rogers.

The principal officers are: hon. treasurer, Professor E. C. Dodds; hon. secretary, Dr. J. H. Bushill; hon. organiser: Lt.-Col. Francis J. Griffin.

The last Congress, which normally is held every four years, was in Rome in 1938; the only previous one to be held in London was in 1909. The first was in Brussels in 1894.

World Developments in

Mono-Esters : Continuous Soapmaking : Glass Silk :

IMPROVEMENTS in glyceride oil compositions which have enabled deterioration of various edible oils and oil-water mixtures to be greatly retarded are the subject of an English patent now open to public inspection (22839-41/1946, Best Foods, Inc.).

The object was to delay the staling, and especially the rancidifying, of a number of oleaginous substances by incorporating agents formerly not applicable because of insolubility or immiscibility.

A mono-aliphatic ester of citric acid, with or without addition of a solubilising agent, such as oleic, stearic or palmitic acids is incorporated. The ester may be dissolved in an oil-soluble aliphatic alcohol or other solvent. The composition so treated may be all oil, as in shortening, or oil/water mixture as in margarine. When added to shortening (hardened oil) quality is improved, such as high lift, high sugar/flour ratio, greater homogeneity and finer texture. A corn salad oil to which mono-stearyl citrate had been added was compared, as to keeping qualities, with other samples in which the corresponding di-ester had been added and in which nothing had been added. These were stored at 95°F. for 62 days and determination of the peroxide values indicated the greatly superior keeping quality of the sample containing the mono-ester.

Similar results were obtained with refined cottonseed oil. Other mono-esters, such as mono-isopropyl citrate, were similarly compared with the corresponding di- or tri- compounds, and proved very superior to the latter. Very good results were obtained with potato chips fried in lard to which the mono-stearyl citrate had been added. Preparation of the citrate is described.

A CONTINUOUS soapmaking process, in which the finished products are made from raw fats in a matter of hours instead of days, has been developed by the American firm of Procter & Gamble.

The process, according to the April issue of *Chemical Engineering*, is continuous counter-current hydrolysis under pressure and at high temperature with a catalyst, followed by continuous distillation, neutralisation, and finishing. The mixture of fats, in the proper proportion for whatever soap is being made, reacts with water under pressure in a vertical column to split into fatty acids and glycerine.

Crude fatty acids coming from the hydroliser are purified by dry vacuum distillation and the distillate is neutralised to yield "neat soap." The neat soap is comparable to that produced in the kettle and may be handled in a variety of ways depending upon the discreed soap product. By-product glycerine recovered from the hydroliser gives a better product than that recovered from the soap kettle. It is concentrated in a multiple effect evaporator which is synchronised with fatty acid production.

From raw materials consisting of 1000 lb. fat, 135 lb. NaOH and 5 lb. salt were obtained 1350 lb. soap (30 per cent moisture), 125 lb. glycerine (80 per cent crude), and 100 lb. still bottoms (for recovery).

It is claimed that greater flexibility, more accurate control, improved glycerine recovery and better soap colour make this process highly valuable.

THE development of many subsidiary but important uses for glass silk is being delayed by a tremendous demand for the product in commercial and industrial practice. Evidence of this was shown at the recent Fuel Efficiency Exhibition in Glasgow where Fibreglass, Ltd., showed a range of industrial and commercial products with little emphasis on the many interesting and important other uses which are being explored.

Among the present developments is the adoption of bitulac compound spraying, replacing resin bonded Fibreglass, for performed purposes. This system permits the spraying of the glass fibre under compression into resilient, semi-rigid preshaped components which fit the purposes for which they are designed, very much as cork compound insulation is presently shaped for insertion in refrigeration units. Another new development in this field is the production of a lagging rope, rather on the lines of asbestos rope, in which the fibre is retained by an outer retaining winding of the same material. This development is designed to permit the easy lagging of pipes by the simple process of coiling and fastening. Other fields include its use as a glass wick, wired mattresses and, treated with P.V.C., wall fabrics and furnishings.

IN a recent Swedish patent, Eng. equivalent 24043/46 (date Aug. 18, 1945) Svenska Oljeslageri A/B claim a method of producing improved drying or semi-drying oils and fats, or products manufactured from them, by using acid of weaker concentration for refining, *e.g.*, sulphuric acid of 35-80 per cent, instead of the customary 96 per cent, and in somewhat larger percentage

Chemical Processes

Improved Drying Oils : Pressure of Oxygen : Nitriding

than usual, such as 2-3 per cent instead of 0.5-1.5 per cent; preferably at room temperature or lower. Little heat is evolved.

Hot pressed linseed oil thus treated is said to be as light in colour as bleached cold pressed, and dries in half the time required for unrefined oil. It also proved to be much better for production of alkyd resins. Several other advantages are claimed.

If air is blown through oil refined by the new method, at room temperature or up to 150°C., and for not more than 60 hours, preferably 24-60, a very good quality oil is said to result, having improved capacity for wetting pigments. Much less time is required for stand-oil boiling and there is economy of nitrocellulose lacquer solvent. Materials for finishing and impregnating fabrics may be prepared. Reference is made to U.S. Pat. 2059259.

A LIGHTWEIGHT instrument for measuring and indicating the partial pressure of oxygen in a mixture of gases, has been developed for the U.S. Navy, according to a report prepared by Dr. Linus Pauling for the National Defence Research Committee under contract with the California Institute of Technology. The instrument, which was developed for use of the U.S. Navy primarily as a measuring device for aviation oxygen breathing equipment, provides analyses accurate to within plus or minus 1 per cent and may be adapted for various oxygen measuring applications. Some other suggested uses are the measurement of the oxygen concentration of air in submarines and other confined spaces, the control of the composition of explosive gas mixtures in explosive factory solvent recovery systems, and simplified oxygen analyses in physiological research.

The instrument utilises the magnetic susceptibility of oxygen, which is several hundred times greater than that of any other common gas, to determine the oxygen content of a gas mixture. The gas to be tested is confined to a cylindrical chamber and a small permanent magnet in the chamber creates an inhomogeneous magnetic field. In order to indicate the magnetic susceptibility of an unknown gas, two small hollow glass spheres connected by a glass tube and mounted on a quartz fibre are suspended horizontally in the chamber. The spheres are filled with air or nitrogen at a pressure of one atmosphere. Rotation of the spheres about the fibre measures the magnetic susceptibility of the gas and hence the partial pressure of oxygen in the gas. A scale indicates the degree of rotation.

As little as a few cubic centimetres of gas can be measured by the instrument or it can be used to indicate continually, with a lag of only a second or two, the partial pressure of oxygen in a stream of gas. The instrument differs from other methods of measuring the magnetic susceptibility of gases in that it uses a small permanent magnet, is light in weight and is rugged. Other methods use a large heavy electromagnet and delicate apparatus.

IN their new method of nitriding for surface-hardening of ferrous metals, for which patents have been applied for, the Nitralloy Corp. of New York City claim to remove the white outer zone usually formed and achieve considerable economy in ammonia consumption. Hitherto it has been customary to remove the outer layer by grinding wholly or in part; and there has also been much waste of ammonia since only about 17.7 per cent is actually dissociated, and the balance of 82.3 per cent simply circulates through retort and is wasted. Of the amount which is dissociated only a very small fraction provides nitrogen which is actually absorbed by the steel surface. It has been generally considered that a too large dissociation of ammonia is undesirable.

According to the present invention the ferrous metal is heated to a temperature within the nitride hardening range, and treated with dry gaseous ammonia or dissociation products thereof. Dissociation range is (a) 15-65 per cent for 5-15 hours during which the initial white layer is formed, and then (b) 65-85 per cent temperature of 925-975°F., for 10-90 hours, during which rate of flow is decreased to permit necessary increase in dissociation, with substantially reduced tendency to form white layer but no appreciable de-nitriding. Further nitriding is finally done at high dissociation rate—at least 85 per cent—for sufficient time completely to remove white layer formed in the first place. Excess nitrogen of white layer is diffused into inner portion of case. Other constituents which may be present in metal are also nitrided, thus adding to total hardness attained.

The British Welding Research Association have issued a booklet in the "Arc Welded Structural Steelwork" series—"Stanchion Bases, Caps and Joints," price 9d.

Bicentenary at Glasgow

Two Centuries of Chemistry in the University

by ANDREW KENT, M.A., Ph.D.

IN 1747 the famous Dr. William Cullen originated instruction in chemistry at Glasgow University. At this time the scientific method so brilliantly exhibited by Galileo and by Newton was inducing a new approach to considerations of the structure of matter. Cullen was an ardent student of Boyle, Stahl and Boerhaave who had attempted to place chemistry on a new and

Professor J. W. Cook, head of the present chemistry department at Glasgow University.

experimental basis. His pupil and successor Joseph Black established the new discipline by his elegant description of the relationship between the carbonates of calcium, magnesium and potassium and his proof of the material difference between the "mild" and "caustic" alkalis.

As a fog of "essences," "principles," panaceas and auriferous illusions was lifted from the laboratories of the savants, "philosophical chemistry" came into a new and fruitful relationship with the associated crafts—metallurgy, dyeing, glassmaking and the rest. Black, William Irvine, a later lecturer, and the first professor, Thomas Thomson, were in fact consultants on a wide range of commercial and agricultural interests. Men like James Watt, Charles MacIntosh and Josiah Gamble had advice and inspiration from the new department, as transformation replaced transmutation and the older chemical industries were accompanied by vigorous newcomers like bleaching-powder and sulphuric acid.

The present department, headed by its regius professor James W. Cook, and housed largely in a new and strikingly modern building, concentrates its research interests to some extent on organic chemicals of physiological importance and on X-ray investigations of molecular structure. These are subjects sufficiently remote from the original and fruitful interest in carbonates and caloric; but the present outpost of advanced chemistry still values its older traditions, conceding the truth of the Newtonian dictum that we stand on other men's shoulders.

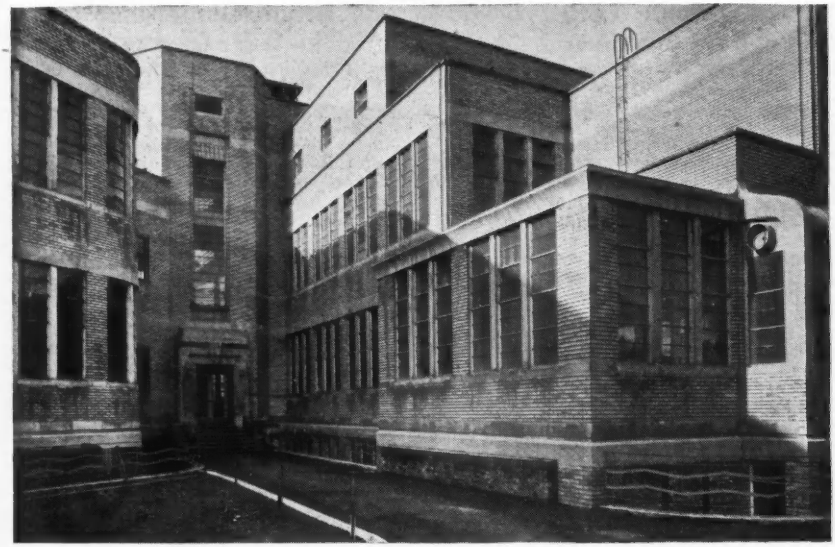
Due preparation has now been made to celebrate the bicentenary of its foundation. In a series of weekly lectures during May (see THE CHEMICAL AGE, May 10, p. 619), Dr. Douglas Guthrie, Professor John Read, and Professor A. R. Todd will pay due tribute to the occasion and Dr. Alexander Fleck will emphasise our notable early association with the chemical crafts. A cordial invitation to attend these lectures is extended to all who are interested. The writer, lecturer on the History of Chemistry, will edit a later commemorative volume where these and other distinguished contributors will describe the personalities, the problems and the achievements of those who launched the department on the excited seas of the chemical revolution.

This university is frankly and pardonably proud of the part it has played, over two hundred years, in the understanding of man's material environment and in the intelligent application of that environment to the service of humanity.

Dr. Douglas Guthrie, Lecturer in the History of Medicine at Edinburgh University, gave the first of the four lectures on May 9 in Glasgow.

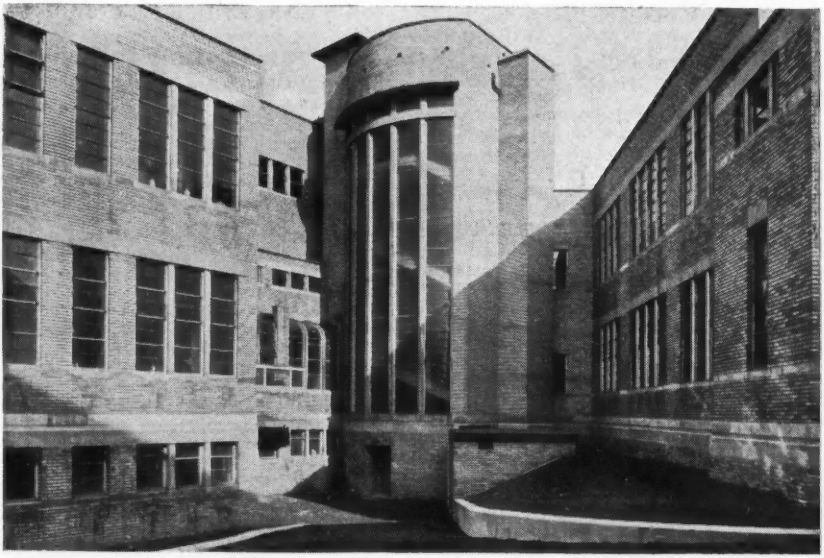
Speaking on "William Cullen and his Times," Dr. Guthrie said that Cullen was the first chemistry lecturer, having been appointed in 1747. He was also the founder of the Glasgow Medical School. Although Cullen published no great work on chemistry he was none the less energetic as an investigator. His researches were concerned with agriculture and with the fertility of the soil in relation to its chemical composition. Another subject on which Cullen worked was the chemistry of linen bleaching.

The Johnson Reprint Corporation, an affiliated company of the Academic Press of New York, is reprinting *Chemical Reviews*, volumes 1-25, at an approximate price of £105 (or £4 10s. each for individual volumes). Orders may be placed through H. K. Lewis & Co., Ltd., 136 Gower Street, London, W.C.1, or any other bookseller.



GLASGOW'S CHEMICAL DEPARTMENT TO-DAY

Though it looks back on a history of two hundred years, Glasgow University's Chemical Department is now housed in the most modern buildings, as these views show



Official Notices

Finnish Patents

THE Board of Trade has issued a licence (S. R. & O. 1947, No. 825) under the Trading with the Enemy Act 1939, authorising the payment to any person in Finland of fees due for the granting or renewal of any Finnish patent, design, or trade mark, or any expenses in connection therewith, including the fees of patent agents. It will be necessary for persons remitting funds to Finland under the terms of this licence to comply with currency regulations, information in regard to which can be obtained from their bankers.

Italian Patents

The Board of Trade has issued Statutory Rules and Orders 1947 No. 448 authorising the payment of any fees or other moneys due for the granting or renewal of any Italian patent, design or trade mark and of any associated expenses.

British Interests in Japan

It was announced in Parliament recently that the Board of Trade is compiling a limited list of representatives of British business interests to go to Japan in due course as a preliminary to the resumption of private trade.

Although no final decisions have been taken nor dates fixed, firms who are interested in sending a representative should register particulars immediately with the Board, as arrangements may have to be made at short notice. Details should be sent to the Board of Trade, 35 Old Queen Street, London, S.W.1.

Agar Control

The Ministry of Supply announces the revocation of the Control of Agar No. 1 and No. 2 Orders under which the usage and price of agar have been regulated. For the future, inquiries regarding agar should be addressed to the Ministry of Food, Chocolate and Sugar Confectionery Division, London Road, Stanmore, Middlesex.

Increased Premium

The Ministry of Supply announces that on and after May 5, 1947, the premium for English refined tin of 99.9 per cent minimum quality as sold by the Directorate of Non-Ferrous Metals will be increased from £3 10s. to £5 10s. per ton. The customary extra of 10s. per ton for 28 lb. ingots will continue to apply.

Report on Proprietary Medicines.—The Pharmaceutical Society has presented a report, based upon a five years' investigation, to the Minister of Health on the advertising of proprietary medicines.

Fuel Conference

Detailed Arrangements

FULLER details have now been issued of arrangements for the four-day conference on pulverised fuel to be held at Harrogate by the Institute of Fuel from June 3-6. Interest in the conference will be heightened by an exhibition to be organised in the Royal Hall, Harrogate, of models of pulverised fuel plants, auxiliaries and other apparatus relating to the subjects to be discussed at the five sessions. The latter will be devoted to the following subjects:

June 3.—Influences of national fuel policy, town planning, methods of mining and preparation; June 4—Drying and grinding, storing, size determination, etc.; burning of pulverised fuel; June 5—Effects of ash, deposits and corrosion, refractory problems, etc.; June 6—Pulverised fuel for gas turbines, locomotives, ships, metallurgical furnaces; summing up by the chairman of the sessions (Chairman: Lord Hyndley).

Badges will be issued and preliminaries carried out on June 2 at the Royal Hall, where the conference offices will be, and the conference will be opened at 10.30 next morning by the chairman, Mr. B. Samuels, immediately following which a civic welcome will be accorded by the Mayor of Harrogate and the conference will be addressed by the Minister of Fuel and the President of the Institute (Dr. C. H. Lander). A number of social and educational activities have been arranged.

The conference secretary is Mr. A. Coe, 18 Devonshire Street, London, W.1.

Sulphur Dioxide in London

Instruments in Big Ben

The Houses of Parliament are being used for scientific investigations by the Department of Scientific and Industrial Research. Instruments for recording the sulphur dioxide in the air have been set up near the top of the Big Ben Tower and on the Speaker's Green.

Sulphur dioxide is one of the causes of decay in building stone, including the magnesium limestone of which the Houses of Parliament are built. Most of it is produced in the combustion of coal. The main object of the measurements being made is to compare the sulphur dioxide concentration at ground level with that at a considerable height above the ground. The vertical distance between the instruments is 238 feet.

The instrument on the Speaker's Green is at the top of the landing steps by Westminster Bridge. The apparatus is contained in a small louvred box on top of a green post five feet high. The other instrument is less noticeable, being on a small platform above Big Ben.

Belgo-Luxembourg Chemical Market

A REPORT was recently published in *Le Bulletin Commercial Belge* by the Vicomte de Lantsheere, Belgian Minister at Berne, on the trade between Switzerland and the Belgo-Luxembourg Economic Union (B-L.E.U.), showing that the latter now occupied third place in Swiss foreign trade, following the U.S.A. and France. Exports from the Union to Switzerland and *vice versa* both showed a remarkable increase during the first seven months of 1946. Exports from the Union in July had reached 28,600,000 Sw. Fr. and imports from Switzerland to the Union jumped in the same month from a monthly average of 12,000,000 to 36,500,000 Sw. Fr.

To some extent the trade between the two countries represents raw material from the B-L.E.U. to Switzerland in return for manufactured goods from the latter; but this is by no means wholly the case. But at all events Switzerland finds the Union a valuable market for many of her chemical products, which have figured largely in her rapidly growing export trade to the Union. Since her economic existence depends more on exports than is perhaps the case with many other countries she has perforce had to study export possibilities more thoroughly than most. Belgium and Luxembourg separately may appear to British manufacturers small and insignificant from the point of view of export trade; but jointly, as an economic union, the market would seem well worth careful study.

Stretching Oil Supplies

PROSPECTS of greatly lengthening the productive life of many oilfields receive encouragement from the success which has attended the "repressuring" operations in the eastern part of the Delaware-Childers field in Oklahoma, U.S.A. In 20 years waning oil production has been boosted by more than 13 million barrels by the injection of 51,000 million cu. ft. of air and gas. Petroleum engineers at the Petroleum Experiment Station at Bartlesville predict that a considerable portion of the estimated 28 million barrels of recoverable oil yet remaining in the sand in this field can be obtained by properly developed water-flooding and air and gas-injection practice.

Discovered in 1906, the Delaware-Childers field produced about 23 million barrels of oil during the first 20 years by primary production methods. With the introduction of air and gas repressuring in 1925 and the extension of this method to include the entire field in the next few years, the rate of oil production increased from approximately 26,000 barrels per month to a peak of 121,000 barrels per month during 1939.

Tar Oil Blaze in Glasgow

IGNITION of oil being heated as one of the processes in producing tar for road mending resulted in a spectacular outbreak of fire last week at Glasgow Corporation's Provan Chemical Works, which supplies local authorities all over the country with road material.

Prompt action by detachments of the N.F.S. kept the fire from spreading to tanks containing thousands of gallons of benzol and naphtha. The alarm was raised by the manager, Mr. David Baird, who saw that three oil storage vessels being heated were alight. It is thought that one of the vessels had developed a leak, allowing the oil to run on to the open fire.

At the height of the blaze a nearby chimney about 150 ft. high was in flames with spurting oil all the way to the top. Burning oil also ran along the ground setting fire to and badly damaging a workers' canteen 30 yards away.

Some naphtha tanks, one of them containing about 12,000 gallons, and other tanks with about 50,000 gallons of benzol, escaped damage. Fortunately the wind blew the fire away from the tar stills. Within half an hour the fire was well under control, and production is not likely to be curtailed as it will be possible to apply improvised methods at the damaged plant.

Acid Tank Fractures

Wearing breathing apparatus for nine hours and working in conditions of great danger, Stretford (Lancashire) firemen on May 9 battled to prevent serious underground explosions when the brigade was called to the Geigy chemical works, in Trafford Park, where a 35,000-gallon overhead tank of highly concentrated oleum acid had fractured and was discharging into a yard and sewers. Five engines pumped a fine spray of water to dilute the acid, as in such high concentration it was likely to cause extensive underground explosions. Water was also pumped directly into the sewers. An alkaline solution was used to neutralise acid which had percolated into an underground duct containing electric cables.

Among the facilities in a training centre which will be operating before the end of June at the Stanton Ironworks Co., Ltd., Stanton, near Nottingham, are classrooms, a technical library, and fully-equipped foundry, engineering and woodwork departments as well as a cinema at which films and film-strips produced by the company, illustrating its own particular products, will be shown.

Montecatini Production

Reconstruction Programme

THE report of the board of directors of the Montecatini Company shows that the Italian chemical industry is making good progress.

Before the war the Montecatini factories were capable of turning out 1,200,000 tons of sulphuric acid and 1,300,000 tons of superphosphates. The war destroyed many plants and the years 1945 and 1946 had to be devoted to their reconstruction. By the end of 1946 reconstruction had advanced so much that the Montecatini group was ready to produce 950,000 tons of acid—77 per cent of their pre-war figure. It is expected that before the year is out their factories will reach their pre-war potential.

The company plans to complete their factories at Ravenna and Montemarciano, to build a new factory at Pavia and to double the existing factories at Licata and Bicocca by 1948. When this programme is carried out it will be possible to exceed the pre-war output.

Shortage of Phosphorites

At present, owing to the lack of phosphorites, the production of superphosphates is lagging behind. Only 400,000 tons of them were produced in 1946. This compares favourably with the 150,000 tons of 1945 but represents only 33 per cent of the 1939 figure.

Production of carbide has suffered from the shortage of coal and electric power. The factory of Villadossola, for instance, in 1946 only worked to the extent of 50 per cent of its capacity. The Domodossola factory which produced nothing in 1945 turned out 7000 tons of carbide and 7600 of calciocyanamide during last year. The factory at Apuania produced 11,000 tons of carbide and 1900 of cyanamide.

Nitrate Production

The reconstruction of the factories engaged in the production of nitrates has gone on for two years and the plants at Merano Novara and Mas can now be said to be in good order. During 1946 about 150,000 tons of nitrate fertilisers were produced and optimistic expectations are justified for 1947.

During 1946 Montecatini Company exported over 600,000,000 lire worth of chemicals. This figure is by no means adequate to their technical possibilities but it was a consoling fact that they were able to send their products to 38 countries. The best customers were: Great Britain, Sweden, Czechoslovakia, U.S.A., and New Zealand. Among the products exported the most prominent were: tartaric acid, finished sulphur, bioxide of titanium and sodium perborate.

Award to Dr. Dana

Work on Liquid Oxygen

FOR scientific work, particularly in the solution of a major distribution problem in the chemical industry, the Western New York Section of the American Chemical Society has awarded the Jacob F. Schoellkopf Medal for 1947 to Dr. Leo I. Dana, research manager for the Linde Air Products Co. and its associated units of Union Carbide and Carbon Corporation.

The award jury's report referred to the laboratory efforts directed by Dr. Dana which led to making large shipments of liquid oxygen and nitrogen "available to industry in a safe and industrially practical manner." With reference to the distribution of oxygen during the war, the jury said, "Shipbuilding activities developed overnight a demand for enormous quantities of oxygen on the Pacific Coast. . . . By transporting liquid oxygen across the continent from as far east as Chicago, all shipyards were able to proceed without interruption during the long months required for construction of production facilities on the West Coast. Time after time during the past war damaging delays threatened by plant failures were prevented by rushing tank cars and tank trucks of liquid oxygen to meet the emergency. . . . So effective were these efforts that at no time was it necessary to place oxygen under any kind of allocation or rationing."

Similar principles were applied to the distribution of nitrogen, used in the making of alkyd resins and, in liquid form, for shrink fitting of metal parts, such as in the assembly line of internal combustion aviation engines. During the war, these liquified gases were loaded into tank cars for shipment to points over a thousand miles away. This method of shipping liquid oxygen and liquid nitrogen, effecting a vast saving in cargo space, was perfected and adapted by laboratory personnel under Dr. Dana. This has also been of value to the coal mining field, which uses liquid oxygen explosives.

In the mining industry, says the jury, the development of fusion piercing of low-grade hard ore by an oxygen-liquid fuel flame, under the inspiration and direction of Dr. Dana, has been extremely important

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Funds for Africa Expansion

African Explosives and Chemical Industries, Ltd., has embarked on a £3,000,000 expansion programme, Sir Ernest Oppenheimer announced last week. Funds for this will be subscribed by De Beers Industrial Corporation and Imperial Chemical Industries equally.

B.I.O.S. REPORT NO. 706

PRODUCTION AND USES OF IRON AND OTHER METAL POWDERS

THIS report is issued with the warning that, should the subject matter be protected by British and/or American patents or patent applications, this publication cannot be held to give protection against action for infringement.

The report contains a considerable amount of information, with details, concerning the production and uses of iron and other metal powders. During the war Germany was unable to produce sufficient quantities of copper powder to satisfy her armament requirements owing to a shortage of the raw material, and as a result iron powder was used as a substitute. Consequently the manufacture of this material was greatly developed and increased. To give an idea of the quantity required, German shell driving bands produced from iron powder consumed 1000 tons per month during the year 1943/1944. In addition, iron powders were used for the manufacture of bushes, bearings, gears, bullet slugs and various armament precision parts.

Iron powder is manufactured by all of the following methods: electrolytic deposition, atomisation, mechanical crushing, and reduction, the largest tonnage being prepared by mechanical crushing using the Hametag process.

Atomisation

As regards atomisation, the report gives full details of the types of nozzles used in the process adopted by the Mannesmann Rohren Werke. The air pressure required is stated to be 4 atmospheres and one ton of metal can be atomised in 12 minutes. The D.G.P. disc method of atomisation from the molten state can be used for any kind of metal so long as oxidation does not take place to any extent when the metal is in contact with air. The principle of the method is as follows. A stream of molten metal passes from a funnel crucible, through a nozzle in the base of the crucible, on to a disc mounted with knives which rotates at a very high speed. The metal stream is cooled by means of a water cone which is formed by a ring nozzle fitted below the crucible nozzle. The particle size is varied by altering the speed of rotation of the disc, and changes in the shape of the particles can be obtained by regulating the cooling water supply. The powder, which is in the form of a sludge, is then dried and if, as in the case of iron, a thin film of oxide has been formed on the particle surface, this must be removed before sintering and pressing. The actual chemical reduction of the oxide can be carried out in an atmosphere of hydrogen using an electrically heated furnace in which the heating elements are made of molybdenum.

Some useful comments are made on the effect of the presence of carbon in the metal; its function in fact would appear to be fourfold. It prevents oxidation during atomisation and is also responsible, to a considerable extent, for the shape and size of the resultant particles which are hollow spheres or saucer shaped. As the carbon content is increased the particle size decreases and figures are given in the report to support this fact. In the annealing process, aggregates of particles are loosened by the carbon combining with the oxygen of the outer layer to form carbon monoxide, this gas itself breaking up still further the atomised particles. In addition, the oxygen/carbon ratio has an important function in controlling the quality of the final product, as on annealing at 900°C., the following reaction takes place:

$$Fe_2O_4 + 3Fe_3C \rightarrow 12Fe + 2CO + CO_2.$$

The oxygen/iron ratio depends on the following four conditions: (1) Temperature of the molten iron. The carbon content is reduced and the oxygen content is increased as the temperature of the molten metal is increased. (2) The width of the annulus of the air inlet and air pressure. An increase in the air pressure or increase in the diameter of the annulus also increases the oxygen content. (3) The diameter of the metal stream. An increase in the size of the metal stream reduces the oxygen content. (4) The distance between the tun dish and the cooling water.

Preparation of Sintered Parts

Highly porous sintered parts can be prepared by compressing at low pressures a mixture of the following constitution: iron powder 92.5 per cent, glue 1.5 per cent, and water 6 per cent. The mixture is first dried and then sintered at about 1100°C. for two hours. Such products find use in filter plates. A method of producing porous parts for bearings is also described in the report. It would appear that self-lubricating bearings are satisfactory for use with high loads at low speeds but are less satisfactory if higher speeds are used. A further disadvantage of this type of equipment lies in the fact that an excessive shaft clearance has to be followed compared with bearings made from porous bronze.

As regards the production of aluminium

powder, a spray method has been developed for the manufacture of this material, using steam at a pressure of 12 atmospheres as the spraying agent. The material is ejected through a specially shaped tun dish with projecting insert, after having passed through a steam nozzle situated on top of the condenser.

The report contains a number of analyses of various powders and some useful photomicrographs are also included. The text includes some information on the determination of oxygen in iron and steel powders with special reference to a method based on the reduction of oxide present in the metal by means of carbon. The main product is carbon monoxide, but any carbon dioxide formed is reduced to the monoxide and the total quantity of carbon monoxide evolved is determined in a gas burette. An advantage of this method is that it does not have to be carried out in a vacuum.

FERTILISER SHORTAGE IN ITALY

10 Per Cent More is Needed

BECAUSE Italy is an agricultural country forced by geographical circumstances to squeeze the utmost from every inch of soil, suitable or otherwise, the production of chemical fertilisers engages the greater part of Italian chemical industry. Every effort has accordingly been made since hostilities ceased to revive that industry, and the production programme for 1946 provided for 1,200,000 tons of phosphates and 580,000 tons of nitrate averaging 18 per cent N.

Those targets were not realised. Phosphate production was 58 per cent of the target figure and nitrate 38 per cent, due to the delay in arrival of phosphorites and the inadequacy of the internal transport system. Fertilisers were too late for the spring cultivations.

At present, 70,000 tons of phosphates are produced monthly in Italy, which represents 60 per cent of the pre-war standard. The technicians are, however, feeling confident that this output can be increased considerably if supplies of phosphorites, the programme for which envisages 750,000 tons in 1947, arrive regularly. There is no difficulty about sulphuric acid as Italy has plenty of pyrites and sulphur of her own.

The output of nitrates was restricted by shortage of coke and of electric power. Only a modest quantity of nitrates will be available this spring.

As the coal situation has lately been improving, it is expected that the output of nitrates during the next twelve months will reach 500,000 tons. If we take the 650,000 tons produced in 1938 as a standard, this figure will represent 80 per cent of the needs of the country.

Reviving Rubber Industry

Rubber is another of the commodities of which Italy is still desperately short, evidence of which is the open black market in motor tyres. When hostilities ceased, production could be resumed only gradually, based on UNRRA supplies. Lately things have improved considerably, but the industry is suffering from the shortage of coal and electric power. Plants are not working to their full capacity and the cost of labour is a heavy burden.

The Pirelli factory is spending at the rate of about 7500 million lire on its personnel and their last balance showed a deficit of over 94 million lire. It was, nevertheless, decided to pay a dividend of 8 per cent and make good the deficiency from the reserve. As the supplies of raw rubber now seem to be assured and the coal situation is tending to improve, it is reasonable to expect improvement during the current year.

Chemical Expansion in Ceylon

THE production of some basic chemicals on a substantial scale forms an important point of the industrial development of Ceylon contemplated in the five-year plan produced by the island's Ministry of Labour. Probable additions to Ceylon's present small industrial capacity are a caustic soda plant, the present consumption being 2000 tons a year; production of synthetic ammonia, of which 28,000 tons are used each year, largely in producing fertilisers, and drugs and fine chemicals, for which there are many indigenous supplies and a big potential market.

Approval has already been given for the erection of a plant for the manufacture of 2000 tons of sulphuric acid annually, the overall cost of building and equipping which will be approximately Rs. 2,500,000 (about £187,500).

Another development on similar lines will result from the decision to convert the Ceylon Government strychnine pilot factory to large scale permanent production of some 1000 lb. a year. The Department of Commerce and Industry has already received inquiries for the purchase of the whole output of the factory, which at current London prices would show an annual profit of Rs. 34,426.

PROGRESS IN DRUGS AND FINE CHEMICALS—V*

by G. COLMAN GREEN, B.Sc., F.R.I.C., A.M.I.Chem.E.

WHILE much work is being concentrated on streptomycin because of its effectiveness against bacteria which are not susceptible to treatment by penicillin or the sulphonamides, work on penicillin continues.

Following the control of penicillin and its preparations by the Therapeutic Substances Act early in 1946, the antibiotic became freely available for retail sale on prescription (S. R. & O., 1946, No. 731; Draft Rules and Orders, 1946, of the Therapeutic Substances Amendment Regulations, 1946). Necessarily, a number of preparations have been made official in the British Pharmacopoeia. The appropriate monograph offers a description and particulars of solubility, stability, methods of assay, storage conditions, labelling and doses. Official preparations include, penicillin injection (sodium or calcium salt) in physiological saline solution of sodium chloride: "*Injectio penicillini oleosa*"—the intramuscular oil injection based on the solution of calcium penicillin in white beeswax and peanut oil; creams; *occulentum penicillini* and *trochiscus penicillini*.

Anglo-U.S. Agreement

In the international field particulars have been published concerning an agreement on the principles applying to the exchange of information relating to the synthesis of penicillin between H.M. Government and the Government of the United States of America (Treaty Series No. 4 (1946), Cmd. 6757). This formalises the exchange of information which has taken place between the two Governments during the war years in their joint endeavour to secure as promptly as possible the production of an adequate supply of high quality synthetic penicillin, or a therapeutic equivalent, at reasonable prices, and also provides, *inter alia*, for the issue of licences so that either country may operate appropriate patents.

In the documents concerned it is interesting to compare the definition of penicillin. The British documents, Therapeutic Substances Act Amendment Regulations, 1946, Draft Rules and Orders, 1946, and the S. R. O. 1946, No. 731, give the definition as "any anti-infective acid produced by *Penicillium notatum* whether obtained from *Penicillium notatum* or not, any salt, or derivative of any such acid, ..." The Treaty Agreement states that "'Penicillin' shall be deemed to mean any sulphur-containing anti-microbial compound characterised by degradation to penicillamine, which may be obtained as a result of the growth of some strain of *Penicillium Notatum*." It will be interesting to see whether either of these definitions will stand the test of time. There is, of course, a difference in objective of the two documents and, for the time being at least, a greater precision and specificity is required of the British document while the Treaty document seeks a definition embracing not only penicillin as the term is understood at present, but also the development of therapeutic analogues.

Prospects of Synthesis

The problem of therapeutic analogues is one to which a great deal of attention will be given during the next few years, for it is now apparent that, while penicillin can be synthesised, the yields are so low, the processes so complex, and the cost so high that there seems little likelihood of the production of synthetic penicillin menacing the investments which have been made in the by now well-established fermentation processes.

At the same time, there is always the possibility that, now the structure of the penicillin is understood, it may be found that one part of the molecule or one or more particular atomic grouping may provide a pharmacodynamic centre which may be susceptible to relatively easy synthesis. Such synthetic materials while not being identical with the penicillin molecule may, nevertheless, be regarded as a therapeutic analogue.

The treaty referred to makes provision for embracing this group of substances by including "therapeutic equivalent" in the definition quoted above and by further defining what is meant by this term thus: "'Therapeutic equivalent' shall be deemed to mean any substance which exerts antimicrobial action, irrespective of the degree of its potency, substantially similar to that of penicillin and which possesses a structure analogous to, homologous with, or derived from that of penicillin or which on degradation can yield either (i) penicillamine or a homologue or an analogue or a derivative thereof."

This seems to limit the field in which therapeutic analogues are to be found for the purposes of the treaty; but it seems to

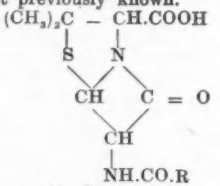
* Parts I, II, III and IV of this review, of which this is the last, appeared in our issues of January 11 (pp. 72–76), February 1 (pp. 184–191), March 15 (pp. 311–317) and April 19 (pp. 477–481).

the writer to leave scope for possible development of therapeutic analogues outside the scope of the treaty.

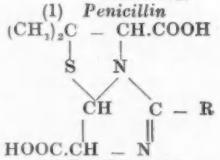
It does not yet follow that therapeutic analogues are achievable. Successes in this direction have been recorded in the development of sulphanilamide from Prontosil Rubrum or 4-sulphonamide-2 : 4-diominoazobenzene and in the development of the antimalarial drug paludrine from mepacrine. The development of the latter was summarised earlier in this review. On the other hand, the attempt to find pharmacological analogues of morphine has failed, as already pointed out earlier in this review, because it appears that the analgesic action of this drug is associated with the substantially intact molecule.

Structure and Chemistry

Details of the structure and chemistry of penicillin were announced at the end of 1945 and were briefly referred to in the contemparary review in this journal. Penicillin, $C_{14}H_{20}O_4N_2S$, has been found to be built on a fused thiazolodine/lactam ring system with the structural formula given by (1) below. It is isomerised to penillic acid (2), a well characterised crystalline compound, by cold acid through an intra-molecular change not previously known.



(1) *Penicillin*



(2) *Penillic acid*

Acid hydrolysis of pencillin gives 1 molecule of penicillamine which is $\beta\beta$-dimethylcystein or $(CH_3)_2C(SH).CH(NH_2).COOH$ (by the production of which by hydrolysis penicillin is defined in the treaty document mentioned above) and one molecule of penilloaldehyde which is $\triangle^{\beta}$-*n*-hexenoylaminoacetaldehyde or $CH_3.CH_2.CH : CH.CH_2CO.NH.CH_2.CHO$. The various penicillins were described in last year's review so that it will be briefly mentioned here that they are with reference to formula (1) above, as follows :

Penicillin	F	(1)	R=C_5H_9 ($\triangle^2$-pentenyl)
,,	G	(2)	R=benzyl
,,	X	(3)	R=*p*-hydroxybenzyl
,,	K		R=*n*-heptyl.

The proportion of each of the penicillins present in the commercial product varies according to the method of production. For example, the deep-fermentation technique, which is being generally adopted because it is not only more economical but also infinitely simpler to operate than the surface-mycelium method, produces predominantly penicillin G (or H), the benzyl derivative, but, according to various conditions a mixture of G and F, – the $\triangle^2$ pentenyl derivative—was obtained.

Surface fermentations, on the whole, have yielded mixtures of F and X, = the *p*-hydroxybenzyl derivative. Moreover, according to changes in conditions, the output of penicillin from a given plant may slowly alter and this has caused some consternation since the penicillins are not all equally therapeutically effective, especially in treating certain important infections.

In the U.S.A., where the economical deep-fermentation process which had such a profound influence on the making available of large amounts of relatively cheap penicillin was developed, the penicillin produced was predominantly G mixed with lesser amount of F. Subsequently to 1944 the character of the penicillin changed. The relative amount of G in the commercial preparation decreased with a corresponding increase in the relative amounts of F and K—particularly in the latter. These changes were certainly the consequence of technical improvements in the method of manufacture and the introduction of new and higher yielding strains of penicillium.

Changed Composition

Coincidently with this change in the composition of penicillin there has been an increase in the purity of the penicillin which has been commercially available. This combination of circumstances has had severe and serious repercussions in the treatment of syphilis where the whole procedure of penicillin treatment has had to undergo revision. This is thought to have been necessary on two counts. First, it is thought that some impurities in penicillin may have been active against trypanosomes either *per se* or in the sense of enhancing the action of penicillin. Second, it has been established that the reduction in potency in post-1944 commercial penicillin in the treatment of syphilis has been due to the increasing content of penicillin K which is therapeutically ineffective. There are essential differences between the penicillins when tested *in vitro*; *e.g.*, taking the effectiveness of the penicillin G as 100 :

Penicillin	*S. aureus* strain used for routine assays	A strain of haemolytic streptococcus	*Spirochaeta pallida*
F (I)	90	82	53
G (II)	100	100	100
X (III)	55	140	50
K (IV)	140	120	75

But, what is more, there are further differences depending upon whether the particular penicillin is tested *in vitro* or *in vivo*. Eagle and Musselman (*Science*, 1946, *103*, 618) record that the differences between the various penicillins in *in vivo* treatment of syphilis far exceeded the differences observed in the *in vitro* treatment. The curative dose (C.D.50) of commercial penicillin, which was mainly G, was established by a number of workers at 1650 units/kg. every four hours for 20 injections. However, in similar conditions, 16,000 units/kg. of penicillin K are not curative.

Qualities of Penicillin K

Similarly, it has been found that penicillin K has been found to be only 9-15 per cent as active as F, G, or X in the treatment of experimental pneumococcus. It is clear, therefore, why dosages have had to be revised as the character of commercial penicillin has changed and why it has been suggested that there should be a limit to the permissible amount of penicillin K in commercial penicillin.

The ineffectiveness of penicillin K *in vivo* appears to be due to the extensive destruction of this, the *n*-heptyl derivative, in the body as compared with the other penicillins. Animal experiments have shown that penicillin K is destroyed in the blood-stream by a relatively thermolabile, non-dialysable constituent of plasma which, however, is not present in any of the highly purified protein fractions of human plasma so far tested.

Coghill *et al.* (*Science*, 1946, *103*, 709) confirm that because penicillin K is so rapidly destroyed in the body it is therapeutically useless and make the following comparisons:

Penicillin	Potency in units/mg.	Per cent. excreted in first two hours after injection	Blood levels of at least 0.03 units/ml. maintained–hours
K	2,300	28	½–¾
G	1,667	83	2–2½
X	900	78	4–4½
No. 128	3,500	58	1–1½

Penicillin "No. 128" is a new penicillin the characteristics of which are not available. The blood levels and excretion figures refer to an injection of 25,000 units. The relative destruction of penicillin K in the body is well brought out in the above table.

Elsewhere, comparative *in vivo* figures have been obtained as follows:

Bacterium	Experimental Animal	*Ratio of effectiveness in vivo* G	K	X
S. pyogenes	mouse	1	1/11	
"	"		1/30	1
Pneumococcus, Type 1.	mouse	1	1/6	
	"		1/8	1
	rabbit	1	1/10	

The proportion of penicillin K present in commercial penicillin was formerly of the order of 8 per cent; but the penicillin now produced by the Q-176 strain of *Penicillium Chrysogenum may* contain up to about 50 per cent of the K variety. The strain Q-176 was obtained after ultraviolet radiation of a culture, and it seems probable that it is a mutant although this fact is believed not to have been definitely established.

By the use of Q-176 the yield of penicillin is reported to have been doubled to 800 units/ml. The assay is clearly referable to *in vitro* technique, for, as already pointed out, the penicillin produced by this strain is therapeutically less effective. Nevertheless, the success obtained by this radiation treatment has prompted the use of other techniques known to be liable to produce mutants.

Colchicine, the characteristic alkaloid of the meadow saffron (*Colchicum autumnale*) is known to be a mitotic poison which arrests mitotic division at the metaphase. In plant cells it produces polyploidy—a multiplication of the number of chromosomes in the cell nucleus. The induction of polyploidy results in the development of a new strain off the organism. Sansome and Bannan (*Lancet*, 1946, *251*, 828) have, however, found colchicine ineffective in inducting polyploidy in *Penicillium notatum*. They were unable, therefore, to confirm the earlier work of Gordon and McKecknie who had obtained higher yields of penicillin by treatment of *P. notatum* with colchicine, a phenomenon which they attributed to the induction of polyploidy although actual chromosome counts were not actually carried out.

Sansome and Bannan attribute the higher yields obtained by Gordon and McKechnie to (1) improved strains obtained by chance; or (2) the selection of high yielding strains by sub-culturing from a culture which might have been affected by the colchicine, or cold, or both, to which the culture was exposed; or (3) colchicine may have had a temporary stimulating effect on penicillin yield for some time after treatment.

Surface and Deep Fermentations

As already pointed out, penicillin X is produced in highest yield by surface fermentation and is becoming increasingly scarce as surface fermentations are superseded by the more economical submerged-mycelium fermentation. Stice and Pratt (*Science*, 1946, *103*, 535) have attempted to overcome the disability of the uneconomic surface-fermentation by the devising of an apparatus in which the surface-fermentation has conferred upon it the advantages of deep fermentation. The apparatus is essentially a series of trays submerged and inverted in culture solution in such a way

that the inverted tray traps a pocket of air, enabling mould growth to take place at the interface.

It is claimed that penicillin may be produced continuously for several weeks without re-innoculation or re-sterilisation. In six or seven days from commencement the titre is 60/70 units/ml. and a portion of liquor may be withdrawn and replaced by fresh culture over three weeks.

During the war, no particulars were made public of the great amount of developmental work carried out in the U.S.A. Details of this work is now being made public and Coghill and his co-workers are publishing a series of monographs on penicillin. In a paper describing the production of penicillin in surface cultures they describe work on the high-yielding NRRL 1249. B 21 strain, a descendant of the original Fleming strain freed from degenerate, mutant strains to the appearance of which it is subject (*J. Bact.*, 1946, *51*, 57). In this paper is recorded the work which led to discovery of the startling increase in penicillin yield when corn-steep liquor is used in the medium, a fact which, in its generalities, has been known publicly for some time.

Coghill and Mozer (*J. Bact.*, 1946, *51*, 79) also report their work carried out from 1942 onwards on the original laboratory scale production of penicillin in submerged cultures by *Penicillium notatum* Westling (NRRL 832), which is unrelated to Fleming's original strain. The best medium, yielding 112 units/ml. in six days, with this strain of mould, contained lactose and corn-steep liquor in about half the concentration found optimal for surface culture production. That is, the deep-fermentation medium contained 40 per cent $^{v}/_{v}$ commercial corn steep liquor of 30° Baume containing 50-55 per cent total solids and 2.75 per cent $^{w}/_{v}$ lactose monohydrate.

Rising Yields

Thus, ultimately, the penicillin yield of 2 units/ml. originally obtained by the British workers in modified Czapek-Dox medium was raised to titres of 169 units/ml. Later strains were isolated after X-ray treatment at the Carnegie Institution to 369 units/mg. Johnson *et al*, by further X-ray radiation and selections raised the yield from 480 to 636 units/ml. Finally, as already discussed above, the strain NRRL 1249.B21, giving yields of 761 to 904 units/ml., was obtained by selection following ultra-violet light irradiation.

Production data was reviewed in detail in last year's review when it was shown that expanding U.S.A. production had reached 700,000 $\times$ 10^6 units per month. In Great Britain, however, plant for the production of penicillin by the submerged mycelium method was still in the course of erection.

During 1946, U.S.A. efforts have been directed towards general consolidation and towards satisfaction of the overseas demand. The importance of this latter effort is reflected in the fact that in March alone nearly 3¼ million vials of 100,000 units of penicillin were exported. With a further 50,000 million units of other products, these exports were valued at $3,264,644—three times the value of all drugs and medicines exported from the U.S.A. in 1932.

The *Foreign Commerce Weekly* (August 24, 1946) states that a unique situation for U.S.A. existed at that date in that penicillin sold abroad is more than twice the volume of home sales. In July, 1946, the exports of penicillin had reached the phenomenal figure of over 13½ million vials worth $8,750,862 and to this had to be added a further $1,128,037, the value of other penicillin products. After this date British competition came to be felt for reasons to be discussed below. The destination of the American exports for the month of July, 1946, was as follows:

S. America	$6,250,079
Liberated areas	$4,533,259
European neutrals	$1,565,830
British Empire	$550,292
Middle East	$245,960
Miscellaneous	$128,380
Total	$13,277,800

Last year saw the commencement of production in the two deep-fermentation plants in Britain. The main producers are the Glaxo Laboratories, Ltd., who have established a factory which operates on a strictly commercial basis at Barnard Castle, and the Distillers Company, Ltd., who are operating the Government factory at Speke near Liverpool as agents of the Ministry of Supply. Operating on a smaller scale are Messrs. Boots, I.C.I., and Kemball, Bishop & Co. The Heyden Chemical Corporation who are large producers in America are reported to be in the course of establishing a factory in Scotland.

The Minister of Supply has refused to disclose the terms of the contracts with producers but has given an assurance that there is no price agreement among manufacturers, and that there are no restrictions on new entrants into the manufacture of penicillin beyond the requirements of the Therapeutic Substances Act.

The product from the Glaxo factory is now labelled as to content of penicillin G II and any therapeutically useless penicillin K IV is additional to the stated units. This practice has also been adopted by another manufacturer in this country. The actual penicillin G is about 90 per cent of the total penicillin in the product as marketed (*Lancet*, September 21, 1946, 439).

Production Process

A brief description of the Glaxo plant has been given (*Pharm. J.*, 1946, 399). The average potency of the product of this plant is 1425 units/mg. and there is about 60 mgm. commercial penicillin per bottle containing 100,000 units. Fermentation of the culture medium which contains corn-steep liquor is carried out in six 5000 gal. fermenters aerated by air which has been filtered through glass wool whence the metabolite liquor is blown by compressed air to an Oliver continuous filter. The mycelium which is filtered off is used for poultry feeding.

Penicillin is extracted by agitation with amyl acetate after acidification with phosphoric acid and the phases are separated by centrifuging. The penicillin is then extracted from the amyl acetate with phosphate buffer, whence it is again extracted with chloroform. The penicillin is finally removed from the chloroform with aqueous caustic soda, a concentration to about one-hundredth the original volume being thus achieved concurrently with purification.

The solution of sodium penicillin is first freed from pyrogens by filtration through asbestos in an "Ertol" filter and then sterilised prior to freeze-drying in glass using "Drikold") with Seitz filter. The dried penicillin is rubbed aseptically through a No. 30 sieve under glass cabinets containing formaldehyde and phosphorous pentoxide.

Manufacture at Speke is carried out in fourteen 10,000 gallon mild-steel fermenters which receive the sterilised mash of lactose, corn-steep liquor and nutrient salts. The culture is built up from the master culture preserved in sand through boiling-tube cultures, 2-litre flasks, 300 gal. fermenters and thus to the main fermenting vessel. Fermentation continues for several days at 75°F. under aerobic conditions.

The air is sterilised by blowing through a column countercurrent to a disinfectant solution. Traces of the latter are then removed by passing the air up baffled columns prior to use in the fermenters. At the completion of fermentation there are about 3 or 4 lb. penicillin per fermenter which is now extracted.

The mycelium is removed on a continuous filter and the penicillin in the filtrate is absorbed on carbon in a stainless-steel vessel. The carbon is filtered out and the filtrate rejected. Penicillin is removed from the carbon by an organic solvent (probably acetone) and the solution is concentrated. The concentrate is then solvent extracted by a process similar to the Glaxo process in glass-lined vessels, passed through a pyrogen and then to a bacteriological filter. A volume of this last solution is measured auomatically into vials to give 100,000 units per vial after which the contents are freeze-dried *in vacuo*.

Pure and Stable

Present methods of processing produce a penicillin of high purity which is nearly white in colour and free from the yellow pigments which formerly contaminated it. This high purity penicillin has a correspondingly higher stability and whereas it was formerly necessary to store penicillin in a refrigerator, this is now no longer necessary since reasonably cool conditions of storage are satisfactory. Of course, once the penicillin has been made into solution it is necessary to store in a refrigerator to minimise the drop in titre.

Rowley *et al.* report a fundamental approach to the solvent extraction of penicillin (*Chem. and Ind.*, 1946, *65*, 237). They point out that in the usual solvent extraction process utilising chloroform and amyl acetate one obtains products of potency 300-700 units/mg. from surface culture and 700-1000 units/mg. from submerged cultures, as compared with a potency of 1670 units/mg. for pure penicillin. Apart from the problem of purity, there are losses amounting to from 30-50 per cent due to inactivation of penicillin by acid, heat, traces of heavy metals, and to incomplete extraction.

From a physico-chemical approach they were able to select a series of solvents which had a greater penicillin solvent power than the customary amyl acetate and which offered the possibility of rapid extraction at *p*H 4.0, at which point inactivation of penicillin is minimised. Ketones were, in general, found to be better solvents than alcohols, and cyclic compounds were better solvents than the corresponding compounds in the aliphatic series.

Methylcyclehexanone and dimethylcyclohexanone were found to be the best solvents among the series examined. Methylcyclohexanone was examined for selectivity. Comparing extraction at *p*H 2.7 and *p*H 4.0 using this solvent the potency of the extracted material increased from 570 to 680 units/mg., as compared with chloroform at *p*H 2.7, which gives a potency of 730 units/mg., but with corresponding larger losses on account of *p*H and lack of solvent power. These findings are the subject of a patent.

It has been pointed out that the current pure penicillin has high stability in storage, but that, naturally, when made up into solution it continues to be intrinsically unstable. Coghill *et al.* have examined the stability of penicillin in aqueous solution (*J. Bact.*, 1946, *51*, 291) as effected by *p*H temperature. Penicillin G has a "half-life" (*i.e.*, the point at which 50 per cent is inactivated) of 2000 hours at 0°C. and *p*H 5.0, reduced to 4.25 hours at *p*H 2.0. At 24°C. the half

life is 92 hours at *p*H 5.0 and 0.31 hours at *p*H 2.0. Comparison of penicillins K, F, X and G shows that, at *p*H 2.0 and 24° C., K is about half as stable as G; F and X are similar in stability and lie about half-way between K and G. The half-lives of K, F, X and G are 7, 11, 11 and 18.5 minutes respectively at the above temperature and *p*H. Clearly these facts are very pertinent in commercial recovery operations.

Low Synthetic Yields

During the war, there were numerous rumours that the synthesis of penicillin had been achieved. It was clear, however, to say the least, that had this been the case the synthesis had not been found to be a feasible commercial proposition, otherwise the large investment in fermentation methods of production would not have been undertaken.

It has been revealed during 1946 that the synthesis was, indeed, achieved by British workers in extremely low yield and that American workers have improved the yield somewhat, but not so appreciably that synthesis on a commercial scale is likely for some time to come.

The full particulars are to be published as a monograph jointly prepared under the auspices of the Medical Research Council (Britain) and the Committee on Medical Research (U.S.A.). In the meantime a limited amount of information has been released (*Nature*, 1946, *158*, 905; *Science*, 1946, *104*, 431).

In 1943, Florey and his Oxford team showed that the penicillin degradation products *d*-penicillamine and 2-benzyl-4-methoxymethylene-5 (4)-oxazolone could be condensed to give an antibacterial substance with a potency of 1 unit/mg. equivalent to a yield of about 0.1 per cent penicillin. Later, by the use of partition chromatography, the American workers achieved a yield of 2.6 per cent. Now, du Vigneaud and his co-workers by the use of Craig's counter current distribution principle, have raised the yield to 16 per cent. The preparation may be crystallised repeatedly as the triethylammonium salt without change of characteristics. All the physical constants agreed within the limits of experimental error with penicillin G (benzyl penicillin) from natural sources.

The substitution of l-penicillamine in the reaction for the *d*-isomer gave biologically inactive products; but *d*-penicillamine may be replaced by *d*-cysteine, the thiolthreonines of β-mercaptoleucine to give new penicillin analogues. This suggests the immediate interest and possibilities of synthesis. It may well be that within a short period an entirely new field of antibacterial research may be opened up.

Wages in U.S. Chemical Industry

A SPECIAL study of wages in the U.S. chemical industry in January, 1946, has been completed by the U.S Bureau of Labour Statistics. Their findings are reported in the April issue of *Chemical Industries*. The most highly paid workers were those engaged on maintenance, their wages ranging from $1.33 per hour for carpenters to $1.60 for lead burners. Among chemical operators proper, class A workers received $1.35 per hour, compressors $1.32, and driers $1.29. The average wage, exclusive of overtime and shift difference, was $1.14 an hour. All categories of workers employed by firms with 500 or more workers received higher wages than companies employing less than 500. There was an average drop of about 10 per cent in the earnings of workers employed by small companies compared with those in larger plants.

Over half the factories studied have a 40-hour week for men, and two-thirds of the factories reported similar hours for women; more large plants had a 40-hour week than smaller establishments. A 48-hour week was operated by about three-tenths of the factories employing men and by one-third of those employing women, while nearly threequarters of the companies contributed in whole or part to some kind of insurance or pensions scheme for their workers.

Since the study was begun the average hourly earnings in the chemical industry had risen in November (the last month on which data is available) by 17 per cent over January, 1946.

New Oil Refinery in Scotland?—The establishment of a new oil refinery on a 1300 acre site on the Clyde, to cost approximately £20,000,000, is reported to be under discussion between an unnamed oil company, the Board of Trade and the Clyde Navigation Trust. The general manager and secretary of the Trust is reported as having stated that he was not at liberty to disclose identity of the oil company, which, he said, had contemplated an extension of its existing premises in the south of England before a Government department suggested it should consider establishing its new oil refinery in a development area. If the refinery were based on Clydeside, crude oil, it is understood, would be imported from abroad and the refined oil and by-products exported coastwise and to near continental ports.

SOUTH AFRICAN CHEMICAL NOTES

From Our Cape Town Correspondent

DESPITE the development of chemical industries in South Africa the Union is offering a good market for a large range of chemicals of British manufacture. In general the trade position and marketing opportunities in South Africa continue bright. There is no danger that what importers buy they will not be able to sell, provided they buy with discrimination. The days of skilled, sound buying are returning, but there is and will continue to be an expanding market for good products rightly priced.

* * *

In the past few years invaluable work has been done in South Africa in meeting the demand for tungsten. The Ore and Metal Co. acted as buying agent for the British Ministry of Supply and purchased all the tungsten available. Small workers whose production was as little as one half or one ton of tungsten per month sold their production direct to this company and were paid at once according to the wolfram percentage, and the ore was accumulated at Cape Town until shipping space was available to send it overseas. The whole of this work was done without charge as part of the company's war effort.

* * *

From Namaqualand, the field parties of the Minerals Development Section, moved into the Pietersburg, Louis Trichardt and Potgietersrust areas to search for corundum and other strategic minerals. South Africa is one of the few countries in the world in which corundum exists in quantity but its occurrence is sporadic and difficult to trace. Corundum is needed in Britain and the United States for polishing lenses, and it was of sufficient war time importance to warrant an intensive search being made for new deposits. Corundum lodes are quarried at several points in the Northern Transvaal.

* * *

A much purer form of oil extracted from seal blubber derived from the Government Guano Islands is being produced by the adoption of methods common to oil manufacturing firms. Under the new process the product contains much less free fatty acid. A seal of about 600 lb. yields about five gallons of oil.

* * *

An impressive programme of expansion is announced in the annual report of African Explosives and Chemical Industries, whose capital commitments already exceed £3 million. Included are an extension of the superphosphate plant to an annual capacity of 500,000 tons; a plant for the granulation of fertiliser compounds; a paint plant and a leathercloth plant at Somerset West; a cyanide plant at Klipspruit, Transvaal; extensions to the ammonia and nitric acid plants at Modderfontein, and the building of laboratories, etc. The net profit for the past financial year was £938,085, compared with £883,156 in 1945. Taxation decreased from £212,857 to £111,748. £450,000 was appropriated to the general reserve, of which £400,000 was capitalised to increase the ordinary share capital to £2,650,000. A cash dividend of 7½ per cent on this amount has now been declared. A subsidiary—the A.E. and C.I. (Pharmaceuticals), Ltd.—has been formed, with a capital of £50,000, of which £25,000 is paid up. Of the debentures, £400,000 is still outstanding.

* * *

A start will shortly be made on Natal's first cement factory, which will ultimately have an output of 200,000 tons a year. The factory will probably be built near Durban and will employ 250 men, mostly South Africans. It is hoped that the first of the three units that will comprise the completed factory will be in operation early in 1948.

* * *

The Liquid Fuel and Oil Bill, which makes provision for the licensing of manufacturing undertakings, will be introduced into Parliament this session, and it will establish a Liquid Fuel and Oil Advisory Board to advise the Minister of Economic Development and Mines. It lays foundations for what is expected to develop into a £20 million industry within a few years. The Bill will provide a system for licensing manufacturers of liquid fuel and oil and all applications will be scrutinised by the Advisory Board. Operations of manufacturing concerns will be very closely regulated as regards quantities produced in specified periods and type of coal used. Other conditions contemplated in the Bill are the maximum number of shares which may be held by aliens in a company holding a licence, the maximum price at which the product may be sold by the holder of the licence and the maximum profits allowed.

* * *

The Director of Food Supplies and Distribution is working on plans for the better distribution of soap in the Union. The actual amount of household and toilet soap for consumption fell from 122 million lb. in 1944 to 88 million lb. in 1946. In 1945, the year before the shortage began to be felt in the Union, 4,329,859 lb. of household and toilet soap was being exported to 26 different countries.

American Chemical Notebook

From Our New York Correspondent

PRICE reductions of two industrial chemicals are announced by E.I. Du Pont de Nemours. They affect the solvents cyclohexanone and "Hexalin" cyclohexanol—reduced from 30 c. a lb. to 25 c. for the former and from 23 c. a lb. to 20 c. for the latter. Cyclohexanone is used as a solvent for vinyl resins in the plastics irdustry, for DDT, and as an ingredient in some paints and lacquers. "Hexalin" is used in dry-cleaning fluids, as a plasticiser and chemical intermediate, and in coating compositions. The new prices became effective on May 1 and are f.o.b. works with mirimum transportation allowed.

* * *

For the seventh time in as many years the Du Pont Company has reduced the price of "Delsterol" "D"-activated animal sterol, in powder form. The new price is a cut of approximately 13 per cent. "Delsterol" is widely used in poultry feeds as a source of vitamin D_3. When the war cut world supply of cod-liver oil, "Delsterol" helped in keeping American egg and poultry production on record levels.

* * *

General Electric Company has announced that it will immediately begin to instal equipment for the manufacture of plastics moulded parts in a newly-purchased factory at Decatur, Illinois, where, when full production is underway by the end of the year, 500 persons will be employed. Partial production at the new plant is expected to begin in May.

* * *

Production of pharmaceuticals, melamine and inorganic pigments will be centred at the new Willow Island, West Virginia, plant to be erected by the Calco Chemical Division of the American Cyanamid Company. The plant construction programme is being carried out under the direction of the Turner Construction Company. Construction of the first manufacturing unit is being pushed to early completion to provide for volume production of folic acid, the new synthetic vitamin for treatment of anemia. Production of melamine is expected to begin later in the year.

* * *

A patent for the froth flotation of chromite with fluoride, patent 2,412,217, owned by the United States Government, has been made available for licensing, upon a non-exclusive, royalty-free basis. The patent provides for a good recovery of high-grade chromite concentrate with very low consumption of reagents. The process for the beneficiation of chromium ores comprises agitating and aerating an aqueous pulp of a comminuted chromite ore in the presence of a long-chain fatty acid having from 8 to 18 carbon atoms, a dispersing agent, and a soluble fluoride at a pulp acidity preferably between pH 2.5 and pH 4.5, and recovering a froth containing a chromite concentrate.

* * *

Investigating new ways to produce magnesium metal, the Bureau of Mines of the U.S. Department of the Interior has conducted a series of tests involving the reduction of magnesium chloride by calcium carbide during which the magnesium chloride was rapidly and almost completely reduced to magnesium at temperatures of 750°C. or higher. In Bureau of Mines tests, however, the magnesium was so closely mixed with other reaction products that it could not be separated by simple methods, indicating little promise for use of the method in present-day commercial production of magnesium. Another objection, apart from the cost of the materials, was that a large proportion of the magnesium chloride was consumed by reacting with lime present in the calcium carbide, forming magnesium oxide and calcium chloride. Technical data are included in a report, "Reduction of Magnesium Chloride by Calcium Carbide," issued free of charge by the U.S. Bureau of Mines, Washington 25, D.C.

* * *

The chemical market in the United States will soon have at its disposal for the first time large quantities of methylal, according to an announcement made this week by the Celanese Chemical Corporation. The company states that ample quantities of this diether can now be obtained for experimentation and assures the industry that volume requirements will be forthcoming if, as, and when needed. Methylal, with a boiling point of 42°C., is an excellent solvent comparable to ether and acetone for certain applications, the company claims, pointing out that this chemical has high solvency for many resins such as cellulose nitrate, ethyl cellulose and polystyrene, as well as for a wide range of other organic compounds. The chemical, made from natural gas, has a relatively low boiling point and its relatively high water solubility, its ability to be salted out of solution and its stability toward alkalis are considered to point up its use as a vaporising, extraction, or reaction solvent in many industrial processes.

PALESTINE'S GROWING PHARMACEUTICAL INDUSTRY

Plans to Supply the Middle East

by ERIC HARDY, F.Z.S.

ONE of the most remarkable developments of industry in the Middle East during the war years was the creation and rapid growth of Palestine's new pharmaceutical industry. Parallel with this, the Palestine Potash Company has expanded considerably its famous Dead Sea chemical works in order to supply natural chemicals for industry. Its original plant now covers the whole of the north shore and when I visited the southern plant at Jebel Usdum I found that this also covers the entire southern shore of the historic sea, with its great settling pools or pans in which the concentrated chemicals crystallise after the water is evaporated off in the fierce sunshine.

Vast Mineral Wealth

From these two plants are produced all the potash, bromine, magnesium, chlorine and common salt (the cliffs at Jebel Usdum are crystals of rock salt), required by the future development of Palestine industries. It has been estimated that the mineral value of the waters of the Dead Sea exceeds the annual national income of the United States.

The country also has large deposits of sulphur and phosphates in addition to the Dead Sea chemicals. Research has also sought to extract iodine from the seaweeds on the Mediterranean coast, and Dr. K. Kohn, in a bulletin on the percentages of iodine obtained from 61 samples of half-a-dozen species of seaweeds from the local coast, has shown that such seaweeds as *Cystosira* and *Sargassum*, both of which grow on British shores (the latter genus including the famous Gulf weed), accumulate considerable quantities of iodine at the end of the summer.

The manufacture of drugs and essential oils, mainly in and around Tel Aviv, proceeds apace, although no longer sheltered by the absence of European and American competition.

Isolated vitamin preparations and citrus concentrates have also been produced for export since the war years. Among the goods now manufactured on a fairly large scale are carbonic acid, oxygen, sulphuric acid and plastics, while insulin has been made experimentally. Superphosphate fertilisers are being produced from the Dead Sea chemical industry's bromine and potash deposits, which have made the country independent of its pre-war imports, and provided an export surplus sufficient to meet the needs of other Middle East countries. Magnesium chloride and calcium chloride also come from the Dead Sea deposits.

Palestine's new pharmaceutical industry is now at the cross-roads. To its advantage is the fact that it has acquired many highly-skilled chemists from Europe and, as I saw on my several visits to their establishments, it has well-equipped laboratories. It has, however, still to grow beyond the stage of importing a number of finished products in bulk for repacking, labelling and retailing.

In the field of organic chemistry and biochemistry, considerable research is being advanced at the Daniel Sieff Research Institute which was founded at Rehovot in 1934. The synthesis of various hormones and vitamins and the study of certain biological activators, their constitution and synthesis, are among the recent investigations there. Much of the work at its well-equipped laboratories is connected with the interaction between matter and micro-organisms, chemotherapy in organic chemistry (to destroy pathogenic micro-organisms) and fermentation processes in biochemistry. The Institute has also synthesised a number of chemotherapeutical compounds including anti-malarials and sulphur-drugs, and it has studied certain polycyclic aromatic compounds. As a result of their research, the pharmaceutical industry is now producing synthetic drugs of high quality which before the war were more or less a German monopoly.

Modern industrial development in the Haifa Bay area is now yielding oil and soap (Nablus is, of course, the historic centre of the production of Palestine olive oil and soap) while a side-line of the Dead Sea chemical industry is supplying the raw materials for the manufacture of photographic materials in Tel Aviv.

Botanical Drugs

In addition to the continued exploitation of the great chemical resources of the Dead Sea, the manufacturing side of the Palestine pharmaceutical industry has now developed an important industry using the botanical drugs obtainable from the local flora. Foxgloves, for example, are now used for the local processing of digitalis for the treatment of heart diseases, and nerve tonics are made from extracts of passion flower (*Passiflora coerula, L.*) which is one of the commonest garden and house climbers in the country. Preparations for heart disease are

also obtained from sea-onions (*Allium*) and for digestive troubles from garlic (*Allium trifoliatum*). Camomile flower (*Anthemis*) is being extensively cultivated along with other medicinal plants such as deadly nightshade (*Atropa belladonna*), Nerium oleander, peppermint (*Mentha piperita*), etc., with good results.

The future of the pharmaceutical industry in Palestine is naturally linked with the future of the country, but internally it is secured by the growing demands of the high standard of living maintained by the new cities of Tel Aviv, Haifa, Jerusalem and other places colonised by Europeans in the past decade.

Its prospects in competion with the industry in other countries are not so easily assured. For one thing the very high cost of production in Palestine will be its handicap in competing with mass production from America. Labour costs are high in Palestine—about 300 per cent of pre-war. The minimum Jewish workers' wage is £5 a week, but with a University at Jerusalem, a technical college at Haifa, and research institutes at Rehovot, there is no shortage of highly qualified technicians. Indeed, the present position finds a surplus of well-qualified German Jewish technicians on the market.

The only Middle East country able to compete with the industry is Egypt, or French industry in Egypt; but the aim of the industry in Palestine appears largely to be one of gaining the Middle East markets that were formerly held by European manufacturers before the war, and to do this before the revival of shipping and production elsewhere.

WATER IN FLUORINE REFRIGERANTS

New Measuring Technique

A NEW technique for measuring the amount of water in "Freon" fluorine refrigerants and certain other organic gases and liquids with an accuracy of one part in a million was described to the American Chemical Society by Messrs. A. F. Benning, A. A. Ebert and C. F. Irwin, of the Organic Chemicals Department, E.I. Du Pont de Nemours & Co. They told of research carried out at the request of Kinetic Chemicals, Inc., a Du Pont affiliate, further to improve the purity of the "Freon" fluorinated hydrocarbons, used as the cooling medium in mechanical refrigerators.

Importance of Content

"In the case of refrigerants, the water content is of special importance," Mr. Ebert said. "This is because moisture in a refrigerating system may result in freezing at the expansion valves, in the corrosion of metal parts, and in the formation of objectionable sludge, and so lead to faulty mechanical operation. To keep these undesirable effects at a minimum it is desirable to keep the water concentration below 10 parts per million. This is to enable manufacturers to make refrigerators that can go ten years without servicing."

Previously, Mr. Ebert said, the moisture content of these products has been determined by passing a sample through a series of carefully weighed tubes of phosphorous pentoxide, which absorbs the water but not the "Freon," and then re-weighing the absorption tubes to see how much water had been picked up. At the low concentrations of water, this method, in the hands of the average analyst, is accurate only to about two parts per million, and in addition requires four hours for the test. The technique described by Mr. Ebert, which makes use of the infra-red spectrometer, is capable of determining the water in "Freon" and certain other fluids with an accuracy of one part per million, and an analysis can be made in five minutes.

The infra-red technique is simple in theory. Invisible light, with a wave length of 2.67 microns, or about one ten-thousandth of an inch, is passed through a transparent cell filled with the sample to be tested. The "Freon" absorbs little of the radiation at this particular wave length, but water strongly absorbs this type of invisible light. Thus, by means of a device which measures and automatically records the intensity of the infra-red light before and after it has passed through the test cell, the amount of water present may be read directly from a calibrated scale.

Colonial Insecticides Committee

The Secretary of State has set up a Colonial Insecticides Committee under the chairmanship of Professor Sir Ian Heilbron, Professor of Organic Chemistry at the Imperial College of Science and Technology, and the vice-chairmanship of Professor P. A. Buxton, Professor of Entomology at the London School of Hygiene and Tropical Medicine, who has spent much time in Africa studying the organisation of tsetse and trypanosomiasis research on behalf of the Colonial Office.

INDIAN CHEMICAL INDUSTRY

New Sulphur Deposits in Mysore

Jamshedpur, India.

A NEW source of sulphur near Chittaldrug, about 150 miles from Bangalore, capable of meeting the demands in South India for the manufacture of sulphuric acid, has been discovered as a result of the geophysical survey and prospecting operations carried out by the Mysore Geological Department. Indications of the existence of extensive deposits of sulphides, principally massive pyrites containing 50 per cent of sulphur, have been given by these surveys. In addition to meeting the demands for sulphur in South India, the mineral, it is stated, will also serve as a source of iron ore for the blast furnaces of the Mysore Iron and Steel Works at Bhadravati. The department is now engaged in intensive prospecting work in the form of putting shafts and trenches in the region.

Ammonium Sulphate Plant

One of the outstanding achievements in the field of chemical engineering has been the perfection of a process for the direct synthesis of ammonia from its elements. In Germany, the Badische Anilin and Soda Fabrique, using what is known as the Haber process, put into operation the world's first successful commercial plant. Since then all over the world several modifications of the original process have been introduced. All these differ principally in mechanical manipulation.

The general design of the pioneer sulphate of ammonia plant in Travancore State in India follows the American process. There are, however, certain fundamental differences which make the plant the only one of its kind in the world. In all previous plants the hydrogen gas needed for ammonia synthesis has been made from either coke or natural gas or from the electrolysis of water. In Travancore a unique process has been devised to utilise effectively and economically the special forestry resources of the State. Wood will be used directly for generating the hydrogen gas needed for synthesis.

The Travancore plant has been designed to produce 40 tons per day of synthetic ammonia, which will be subsequently changed into 150 tons per day of sulphate of ammonia by reaction with gypsum and sulphuric acid. The raw materials used in the entire process will be (1) wood 320 tons per day, (2) gypsum 150 tons per day, and (3) sulphur 25 tons per day.

Besides producing sulphate of ammonia, this plant will have a surplus of 17 tons per day of 98 per cent sulphuric acid and several by-products like calcium carbonate, cement quality gypsum, carbon dioxide gas, wood tar and tar distillation products.

Sindri Fertiliser Factory

It is anticipated that pilot production of ammonium sulphate in the Sindri Fertiliser Factory will start early in 1949 and that full production will be established by the middle of 1950.

The factory is estimated to cost Rs. 10.76 crores and produce annually about 350,000 tons of ammonium sulphate and 100,000 tons of cement. The first instalment of plant from abroad is expected to arrive by the end of 1947. An agreement has been concluded with an American firm for the design of the factory. Another agreement is in the process of negotiation with Messrs. Power Gas Corporation, Ltd., for the supply of some plant and for the construction of the factory. Orders for about three-quarters of the plant and machinery required have been placed in India, in the U.K. and in the U.S.A.

The Sindri factory is to be managed by a Statutory Corporation in which the Central Government, Provinces and States will participate. Such Provinces and States as agree to contribute Rs. 25 lakhs of capital or guarantee 25,000 tons annual off-take per annum for a period of ten years will be entitled to nominate a member to the board of management.

Dr. R. S. Krishnan, one of Sir C. V. Raman's principal pupils, has succeeded in obtaining the complete " Raman Spectrum " on white sapphire or pure corundum. The spectrum obtained by Dr. Krishnan consists of seven different lines, each of which represents a particular mode of oscillation of the aluminium and oxygen atoms in the corundum.

Bristol Oil and Colour Chemical : New Officers

THE annual general meeting of the Bristol Section of the Oil and Colour Chemists' Association was held at the Royal Hotel, Bristol, on Friday, April 25.

The following officers were elected for the session 1947/48 : Mr. V. C. Thompson, chairman; Mr. C. G. Phillimore, hon. secretary; Mr. R. C. Crane, hon. treasurer; Mr. R. M. Irving, hon. publications sec. Three new committee members who were elected to replace retiring members were : Mr. C. Pearce, Mr. W. J. McWaters, and Mr. R. R. Stevens.

A Chemist's Bookshelf

Micro-Diffusion Analysis and Volumetric Error. By Edward J. Conway. London: Crosby Lockwood and Sons, Ltd. Second Edition, pp. xix + 357. 21s.

A second edition of Professor Conway's well-known textbook is very welcome. Analytical chemists and, in particular, those concerned with microchemical analysis will be familiar with the first edition of the book, and may also have applied some of the diffusion techniques which have been described in the literature since the appearance of the first edition in 1939 and which are here included. As in the first edition, the present work is divided into three main sections: a general section describing the apparatus and principles used in micro-diffusion analysis; a detailed description of the applications of the technique; and, finally, a discussion of errors in titration.

New Methods Described

It is the middle section, which comprises roughly one-half of the present edition, where, as one would expect, the principal extensions have been made. The other two sections are largely, though not completely, unchanged. New methods have been devised, and are described, for the estimation of the various forms in which nitrogen may occur. Thus, more detail of the absorption of ammonia in boric acid is given, while methods are described for nitrites and nitrates. Iodides and mixtures of halogens, and miscellaneous substances of biological importance such as glucose, carbonic anhydrase, ethyl alcohol and carbon monoxide are all useful additions. Due regard has been given to diffusion methods, published during the past few years, which use vessels other than the standard Conway unit. A second edition of this book needs no recommendation from the reviewer. It is sufficient to say that it is a worthy successor to the first edition in its contents and its construction. A minor criticism might be directed towards the rather sketchy treatment of the Spekker Absorptiometer, which falls between two stools and is either inadequate or superfluous; while Fig. 21, illustrating its optical principles, could be confusing, since it uses the letter G indistinguishably to indicate an iris diaphragm and a galvanometer (which latter, at first sight, appears to have no connection with the remainder of the diagram). The book is well printed and produced, and is adequately bound to meet hard usage. Several errors have been noted, however, in the list of references which forms a six-page appendix.

Technical Publications

THE exceptional opportunities for schoolboys and girls to fit themselves for important work in industrial or research physics laboratories, with the prospect of continuing their part-time training to qualify for almost any position the science has to offer, without attendance at a university, are attractively set out in the illustrated booklet issued by the Institute of Physics. The Institute, in collaboration with the Ministry of Education, is sponsor of this scheme which is open to all who have had a continuous education to the age of 16 or have satisfactorily completed a junior part time course of two years after leaving an elementary school. It provides courses of three years' part-time study, concentrating on practical aspects, successful completion of which will secure for the student an ordinary National Certificate in applied physics. This will qualify the student for appointment as an experimental assistant and enable him to gain by a further two years' study the Higher National Certificate, conferring full professional status as a physicist.

Chemicals from Petroleum

Of interest as a comprehensive short review of many of the industrially important chemicals being derived from petroleum is the booklet issued in connection with their B.I.F. display by Petromor, Ltd., and the Raven Oil Co., Ltd. This provides the salient facts about petroleum aromatic extracts, oil-soluble petroleum sulphonates, fat-splitting agents and detergents, and wetting-out agents with which the companies are concerned.

Steel and Rubber

The 12th monthly issue of "Philips Technical Review" by Philips Lamps, Ltd., concludes Vol. 8 of the series and contains indices giving easy reference to articles published in the previous issues from 1936 to 1946. The "Edgar Allen News," organ of Edgar Allen & Co., Ltd., Sheffield, surveys a number of notable developments in steel technology and the use and maintainence of tools and plant. In "Developments in Rubber" the Andre Rubber Co., Ltd., deals with several highly technical aspects of rubber and rubber-bonded-to-metal applications in a way which will commend itself particularly to engineers requiring rubber in their plants. Catalogue 505 by A. Gallenkamp & Co., Ltd., provides the latest information and specifications relating to the company's range of electrical laboratory apparatus, to which there have been many recent additions.

Parliamentary Topics

Future of German Chemical Plants.—German chemical and heavy engineering industries in the British zone, unlike coal mines and iron and steel plants, have not been placed under the Commander-in-Chief's control, but, with other large-scale privately-owned industries, they are subject to the decartelisation law, which aims at the destruction of undue accumulations of economic power. All these industries are ultimately to be placed under German public ownership. —Mr. C. P. Mayhew.

70,000 Tons Less Steel.—Approximately 70,000 tons of steel were lost by the fuel shortage in February and March at the Sheffield steel works.—The Joint Parliamentary Secretary, Ministry of Supply.

Canadian Aluminium.—Mr. F. Beswick asked the Minister of Supply what quantity of aluminium his department has contracted to import from Canada over the next 18 months.—Mr. A. Woodburn: A contract has been placed for 215,000 tons of which delivery began last year and will be completed within the next 18 months.

Glycerine Exports Up.—Mr. W. Shepherd asked the President of the Board of Trade why the tonnage of glycerine exported in 1946 was higher than that exported in 1938, despite the fact that many important industries in this country have had their activities curtailed through lack of glycerine supplies. —Mr. L. Wilson: The increase in 1946 arose from the fulfilment in the early part of the year of a commitment to the U.S.A. entered into in 1945 when stocks were substantial and there was no reason to anticipate the shortage which developed subsequently. Other exports were considerably below those of 1938.

Titanium Pigment Manufacturers' Committee

THE Titanium Pigment Manufacturers' Technical Committee has appointed Mr. S. G. Tinsley (of British Titan Products Co., Ltd., Billingham, Co. Durham) as chairman, and Mr. J. T. Richmond (of National Titanium Pigments, Ltd., Luton, Beds.) as secretary. The new title of this committee, which was constituted in 1944 as the Titanium Pigment Manufacturers' Specification Committee, indicates the wider field now covered. In addition to advising on specification matters concerning titanium oxide in the pigment, paint and related industries, the committee also deals with such technical matters as are considered by the titanium pigment manufacturers in the United Kingdom to require its attention.

Next Week's Events

MONDAY, MAY 19

Royal Society of Arts (Dominion and Colonies Section). John Adam Street, Adelphi, W.C.2, 5 p.m. Mr. E. R. Davies: "Recent Developments in the Application of Photography." (Cantor Lecture.)

WEDNESDAY, MAY 21

The Institute of Metals. Institution of Civil Engineers, Great George Street, S.W.1, 6 p.m. Sir Wallace Akers: "Metallurgical Problems Involved in the Generation of Useful Power from Atomic Energy."

North-Western Fuel Luncheon Club. The Engineers' Club, Albert Square, Manchester, 12.30 p.m. Dr. A. Parker: "Fuel Quality and Efficiency."

FRIDAY, MAY 23

Society of Chemical Industry (Food Group and Birmingham and Midland Section). Birmingham Chamber of Commerce, New Street, Birmingham, 2.30 p.m. Dr. B. A. Southgate: "Effects of Polluting Discharges," and Dr. S. H. Jenkins: "Principles of Trade Waste Treatment."

SUNDAY, MAY 25

Society for Visiting Scientists. Beaver Hall, Garlick Hill, E.C.4, 7.45 p.m. Langevin Memorial Meeting (open). Monsieur P. Biquard: "Langevin as Scientist, Man-of-Affairs, and Friend."

Chemical Pulp Price Increase

CANADIAN pulp manufacturers have announced a boost in the export price of all grades of chemical pulp. The increase, which averages $10 a ton, ranges from $6 to $12 depending on the particular manufacturer. This new price for chemical pulp does not affect newsprint. Chemical pulp is processed by breaking wood and cooking it in an acid or alkaline liquid while groundwood pulp, which is not affected by the increase, is manufactured by reducing wood by means of a grindstone.

Approximately 90 per cent of Canadian chemical pulp is exported to the United States, where it is used in the manufacture of plastics, celanese, rayon, photographic film and other allied paper products.

Canadian chemical pulp prices were increased earlier this year and are not affected by this new price. United States producers recently raised their prices by about the same amount.

An official of the Canadian Pulp and Paper Association said recently that Canadian exports of chemical pulp to the United States last year totalled about 1,500,000 tons.

Personal

MR. T. E. HARRIS, Bowdon, chemical manufacturer, left £87,217, net £86,699.

SIR WILLIAM A. STANIER has been appointed a director of Courtaulds, Ltd.

MR. THOMAS SHACKLADY, retired analytical chemist, West Knowe, Glenpatrick Road, Elderslie, Renfrewshire, left £12,313.

MR. G. E. BEDFORTH, Putney Heath, London, of Messrs. M. Bedforth and Sons, drysalters and soap manufacturers, Aspley, Huddersfield, left £29,764, net £29,418.

MR. T. M. WILLCOX (general manager) and MR. A. SHARP (secretary) have been appointed directors of the Clayton Aniline Co., Ltd.

DR. A. C. WAINE, chief research chemist of Triplex Safety Glass Co., Ltd., has been appointed lecturer in bee-keeping to Studley Agricultural College, Warwickshire.

PROFESSOR H. C. UREY, of Chicago, was one of four foreign scientists recommended by the Council of the Royal Society for election as foriegn members.

MR. EDWARD CARR DEAKIN, of Brocklebank Road, Southport, bleacher, a former managing director of the Bleachers' Association, Ltd., left £80,961, net £80,588.

MR. G. A. S. NAIRN, chairman of Lever Brothers (Port Sunlight), Ltd., has been appointed vice-chairman of North-Western Regional Council of the Federation of British Industries.

PROFESSOR E. L. HIRST has been appointed to the newly instituted Forbes Chair of Organic Chemistry at Edinburgh University. He is at present Sir Samuel Hall professor and director of the chemical laboratories in the University of Manchester.

SIR ALEXANDER FLEMING shares with many American ex-G.I.s the right to wear the U.S. war decoration, the Order of the Purple Heart. This was handed to the British Consul-General at Hollywood on Sir Alexander's behalf, in recognition the saving of lives which penicillin made possible during the war.

SIR FREDERICK BAIN, president of the Federation of British Industries, is visiting Canada at the invitation of the Canadian Minister of Trade and Commerce. Accompanied by MR. MOIR MACKENZIE, Deputy Director-General of the F.B.I., he will take part in discussions in Ottawa with Ministers and representatives of Canadian industry. Sir Frederick is also to address the Canadian Chamber of Commerce and the Canadian Manufacturers' Association.

Appointment of MR. WALTER J. BEADLE, of Wilmington, Delaware, as a director of Canadian Industries, Ltd., to fill the vacancy caused by the resignation of MR. J. Thompson Brown, for almost 27 years a director of the company, is announced by George W. Huggett, president and managing director of C.I.L. Mr. Beadle, who has an extensive knowledge of the chemical industry, is a director and vice-president and treasurer of E.I. Du Pont de Nemours & Co. A native of Lima, New York, and a graduate of the Massachusetts Institute of Technology in 1917, he started with the Du Pont Company in 1928 after serving in various engineering capacities with other chemical companies in the United States. Before entering the treasurer's department, he was assistant director of the development department of the Du Pont Company.

Four new members will join the Council of the Textile Institute as a result of the annual postal ballot to fill eleven places. They are MESSRS. W. A. EDWARDS, F.T.I., Loughborough, immediate past chairman of the Institute's Midlands Section; J. DAY, A.T.I., Dewsbury, a member of the Council before the war, who has regained the place he resigned on joining the Forces; E. M. GRAY, Manchester, Director of the Recruitment and Training Department of the Cotton Board, and L. MORRIS, hon. secretary of the Institute's Bolton branch. Members re-elected are: PROFESSOR J. B. SPEAKMAN, F.T.I., Leeds University; DR. F. C. WOOD, F.T.I., Manchester; MR. A. W. BAYES, F.T.I., Hyde; DR. A. J. TURNER, F.T.I., Belfast; MR. W. HOWARTH, F.T.I., Bolton; MR. E. J. POOL, F.T.I., Leeds, and MR. G. S. SCOTT, A.T.I., Keighley. There were 23 candidates for the eleven places.

Obituary

MR. JOHN MCKIE, who has died, aged 72, studied chemistry under Dr. G. Tate and subsequently became senior chemist to Tate & Lyle, Ltd. He was a former member of the Society of Chemical Industry.

MR. CHARLES ARKINSTALL, chairman of Arkinstall Bros., Ltd., galvanisers and sheet metal workers, Coventry Street, Birmingham, and of Keeps Construction Co., Ltd., Barn Street, has died in his 73rd year.

MR. WALTER DE LA ROCHE BOND, who retired from Fort Dunlop as personnel manager last July after 54 years' service in the rubber industry, has died aged 68. He started work with Byrne Bros. India Rubber Co. at Coventry.

Home News Items

Sulphur Prices.—By a Board of Trade Order, the price of ground sulphur has been increased by 7s. 6d. ton.

Chemicals and Oils.—Wholesale prices of chemicals and oils in April—according to the Board of Trade table of index numbers—were 4.9 higher than in the previous month, 18.9 higher than in April 1946, and 82.8 higher than in 1938.

Scottish Lead.—The Scottish Council (Development and Industry) plans to develop the lead mines at Bargaly and Palnure in Galloway. There are said to be rich lead deposits in other parts of the area, to which the Council's attention has been drawn.

Wax From Peat.—The Highlands and Islands Development Company, Ltd., are to install a plant for the manufacture of ester wax in the North Connel district of Argyll, where they have obtained a lease of a peat bog at Acnaree which has been found by research workers to contain a high proportion of the wax.

Magnesium Output Curtailed.—At the magnesium alloy factory, owned by Magnesium Elektron, Ltd., at Clifton Junction, near Manchester, the number of personnel has, in spite of increasing orders for home and export trade been reduced from a war-time peak of well over 2000 to 350, following a Government instruction that only a limited amount of power is available. Foundries used for the production of finished alloys will continue to work from stock material, but the plant which makes the metal itself from ore will temporarily be out of commission.

Consumption of Non-Ferrous Metals.—Consumption of non-ferrous metals in the United Kingdom during the first quarter of this year was in each case down on the figure for the October-December period last year, according to Ministry of Supply statistics. Consumption of virgin zinc was 48,701 tons, compared with 60,023 tons in the previous quarter and a total of 216,089 for the year 1946; virgin lead, 42,535 (44,154, 193,506); virgin tin, 6663 (7143, 25,506); virgin cadmium, 122 (131, 542); virgin antimony, 1160 (1344, 5623). Of the total consumption of zinc, 17,770 tons went into galvanising and 11,710 into zinc oxide. The cable trade was the biggest consumer of lead, taking 20,961 tons. Among trades using tin, alloys (whitemetal, bronze, gunmetal, etc.) absorbed the most, 3485 tons; followed by tinplate, 2074 tons; solder, 1552 tons. Of the total of antimony metal and compounds consumed (in terms of antimony metal), oxides and compounds took 498 tons.

Atom Ships Still Dangerous.—According to the U.S. Navy Department the target ships used for the Bikini atom bomb tests in March last year are still "unsafe for permanent occupying."

Whale Oil Arrives.—The whale factory ship *Balaena*, arrived at Southampton from the Antarctic on Sunday night. She carried a cargo of 61,000 barrels of oil. After leaving Southampton on Tuesday for Scandinavia the *Balaena* ran aground on a sandbank off Walton-on-the-Naze.

Rising Wages.—Average weekly earnings of 5¼ million manual workers increased 75 per cent between 1938 and 1946 (October). The Ministry of Labour Gazette, which records this, gives the average earnings of manual workers last October as 120s. 9d. Girls, receiving an average of 38s. 8d. weekly, were getting 109 per cent more than in 1938.

Shipyards Short of Steel.—Unless steel supplies are quickly increased, shipyards throughout the country will experience large-scale unemployment. That is the view of a representative group of British shipbuilders, who have called a meeting in London with the intention of making representations to the Government.

Health of Chemical Workers. — The hazards to which the health of chemical workers are alleged to be exposed in the processing of metals such as vanadium, beryllium, cadmium and osmium, is the subject of an article by the acting general secretary of the Chemical Workers' Union, in the Chemical Worker, an advance copy of which is being circulated independently.

German Patents.—Replying to Russian criticism of the use by Britain of German patents, Sir Stafford Cripps at the annual dinner of the Chartered Institute of Patent Agents at Grosvenor House last week, said knowledge of German patents was made available to the whole world. "The Russians," he added, "have been the best and most consistent purchasers of reports on German production methods."

I.C.I. and Official "Squatters."—Reference to the inconvenience caused by the Government's unwillingness to de-requisition the company's London offices, I.C. House and Thames House, was made by Lord McGowan, chairman of I.C.I., Ltd., speaking at the annual meeting. The Ministry of Supply and the Board of Trade, he said, were so comfortable that they had no desire to move; this was "squatting on a remarkable scale."

Overseas News Items

Chinese Tung Oil.—It is planned to ship this year 141,000 tons of tung oil from China, of which 7000 tons will come to this country.

U.S. Alcohol Prices Up.—The price of industrial alcohol has been increased in the U.S. by 16 c. to 98 c., owing to the sharp rise in the price of maize, molasses, etc.

Pyrethrum Production.—Pyrethrum output in Yugoslavia totalled only about 100 tons last year, but a considerable expansion is expected in future, mainly for export to the U.S.S.R.

More Saudi Arabian Oil.—Saudi Arabia's oil output amounted to 8,570,000 metric tons last year, as compared with 3,043,000 tons in 1945 and only 650,000 tons in 1943, states the Petroleum Press Service.

Part Use of Sterling Loan to Austria.—Out of the £10 million loan granted to Austria by this country, £155,000 will be spent on insecticides, £400,000 on fertilisers and about £336,000 on pharmaceuticals.

Hesse Resumes Chemical Exports.—According to the director of the U.S. Military Government of Hesse, firms in the province have concluded contracts for the export of chemicals to Norway, and pharmaceutical products are to be sent to the Netherlands.

French Chemical Industry Plan.—The French Government is reported to be considering the appointment at an early date of a special commission to inquire into the modernisation of the country's chemical industry.

Kenya Unsuitable for Groundnuts.—Discussions have taken place in Kenya regarding the local position in connection with the British Government's scheme to produce groundnuts in East and Central Africa, but it is not expected the colony will participate owing to its unsuitable climate.

Standardisation of Penicillin.—The Interim Commission of the United Nations World Health Organisation, meeting at Geneva, decided to continue to work out an international system of penicillin standards, following up the war-time work in this field by the League of Nations.

$1800 for Graduates.—Post-graduate fellowships in chemistry which the United States Rubber Co. is financing at the University of California will provide male students working for their doctorate in chemistry $1200 a year if single and $1800 a year if they are married. The university will receive $1000 a year for each fellowship to cover fees and laboratory expenses.

Argentine Uranium.—A discovery of uranium-bearing material in Mendoza Province has been confirmed by experts of the University of La Plata.

Export Duty on Cinchona Bark.—It is reported that an export duty of 30 per cent will be imposed on cinchona bark in the Dutch East Indies.

Norwegian Wood Spirit for U.K.—A consignment of about 1,000,000 litres of Norwegian wood spirit will be shipped to this country from Sarpsborg.

Polish Coal.—The coal production of Poland is the largest in Europe after the incorporation of Upper Silesia. The total production in 1946 was 47 million tons, of which 14 million tons were exported.

Caustic Soda Plant for Algeria.—A plant for the manufacture of caustic soda and chlorine is to be built in Baba-Ali in Algeria. Output is expected to total 3000 tons of each annually.

Hungary's Petroleum Output.—Monthly oil production in Hungary totals now 550,000 metric tons. Owing to the excessive exploitation carried on during the war by the Germans, it is at present not proposed to step up this figure.

Pacific Sulphur Deposits.—A survey of the high-grade sulphur deposits on Tori Shima, in the Ryukyu group of islands, disclosed the possibility of rehabilitating the sulphur mining industry there, states the U.S. Army report on activities in the islands. Equipment is said to be available on Okinawa.

Swiss Chemical Developments.—Biochemie G.m.b.H. is a newly established firm in the Tyrol for the production of penicillin. The Alpine-Chemical A.G. in Kufstein has started a plant for insulin, and the Elchemie G.m.b.H. has begun the electrochemical production of hydrogen peroxide.

Oil Prospecting in Brazil.—Following the discovery of new oil-producing wells near Bahia and the offer of the Standard Oil Company to invest 200 million cruzeiros in oil prospecting in the country, Mr. Herbert Hoover, Jr., and Mr. A. Curtiss, specialists in petroleum questions, have arrived in Rio.

New Process for Acrylic Resins.—A new process for the manufacture of methyl methacrylate resins, developed for the Chinese Government by the U.S. Brothman organisation, utilises acetylene and acetone rather than hydrocyanic acid and acetone. It consists of an entirely new monomer synthesis and polymerisation method.

Company News

In 1946, **Anglo-French Phosphate Co., Ltd.**, earned a net profit of £22,755 (£28,908), and a dividend of 12½ per cent (15) is being paid.

The name of Chemical Sales, Ltd., 9 Victoria Street, London, S.W.1, has been changed to **Cambrian Chemical Industries** as from March 24, 1947.

The nominal capital of **Cross and Max (Agencies), Ltd.**, chemicals, etc., 17/18 Bishops Court, London, E.C.4, has been increased beyond the registered capital of £1000 by £100 in £1 ordinary shares.

A net profit of £361,873 (£349,576) is announced by **British Match Corporation, Ltd.**, with a final dividend of 5½ per cent and bonus of 1 per cent, making a total of 9 per cent (same).

The nominal capital of **River Chemical Co., Ltd.**, Lion Works, Moorgate Street, Nottingham, has been increased beyond the registered capital of £3000 by £7000 in £1 ordinary shares.

Preliminary statement by **United Molasses Co., Ltd.**, shows consolidated trading profits for 1946, including previous years' profits now available, of £1,069,378 (£880,404 for 1945). Net trading profit was £589,159 (£449,872). The final dividend is 17½ per cent, making a total for the year of 27½ per cent (22½).

In connection with the financing of the development scheme of **Monsanto Chemicals, Ltd.**, applications were invited this week (the list closing on Wednesday last) for 1,500,000 3¾ per cent redeemable cumulative preference £1 shares and 600,000 ordinary 5s. shares at 21s. and 42s. 6d. per share respectively. The company's development scheme includes as the first stage, costing some £2,000,000 and taking about three years to complete, the extension of its works at Ruabon in North Wales and the erection of a new factory at Newport, Mon.

Wm. Butler & Co. (Bristol), Ltd., whose preference capital is quoted on Bristol Stock Exchange, announced its intention recently to apply for a quotation for its ordinary capital. Issued capital of the company is £119,573 in 5½ per cent cumulative preference units of £1 each and £246,898 in ordinary units of 5s. each. The dividend for 1946 was 12½ per cent, less tax, out of earnings of 25 per cent on the ordinary capital. Dealings will probably commence in the 5s. units of ordinary stock around 14s. 6d.-15s. The 5½ per cent cumulative preference are currently quoted at 28s.

Drying oils and white pigments are causes of the principal commodity "bottle necks" to increased productivity in the paint industry in the opinion of Mr. C. G. Heywood, chairman of **Pinchin, Johnson & Co., Ltd.**, in the annual statement. Pointing out that drying oils are indirectly the product of agricultural activity, he says it has been a shock to the industry to realise how little of the Empire has been surveyed for the cultivation of oil seeds or nuts which might render us at least partially independent of non-Empire sources. Technical research, he adds, has succeeded in splitting non-drying oils, formerly of little use to paint technology, into two or more fractions, one of which, and generally the largest fraction, produces drying oils fully equal to the normal performance obtained with linseed. The company's profit for 1946, £861,969 (£418,066), was a record. The final dividend of 15 per cent makes a total of 20 per cent (15), plus bonus of 5 per cent (nil).

New Companies Registered

Roebank Chemical Co., Ltd. (25,291).—Private company. Capital £1000 in £1 shares. Importers and manufacturers of chemical, industrial and other preparations and articles, etc. Subscribers: W. Graham; T. McLean. Registered office: 187a West George Street, Glasgow.

Frossol, Ltd. (434,304).—Private company. Capital £100 in 10s. shares. Manufacturers of anti-freeze solutions and compounds, chemical compounds, etc. Directors: A. Carr; A. Osborne. Registered office: Hazelwood, Newlay Wood Avenue, Horsforth.

Lister-Todd Engineering Corporation, Ltd. (434,749). — Private company. Capital £100,000 in £100 shares. Manufacturers of equipment for manufacturing and applying disinfecting, purifying, sterilising and fertilising preparations, etc. Subscribers: B. Borkoff; H. Donnell. Registered offices: 15 Kingsway, London, W.C.2.

Jensen Lawson & Co., Ltd. (434,396).—Private company. Capital £30,000 in £1 shares. To acquire business of chemical merchant carried on by A. F. Lawson at 136-142 Victoria Street, London, as "Jensen Lawson & Co." Directors: C. Fountain; Albert and Aimee Lawson. Solicitors: Dawson & Co., 2 New Square, London, W.C.2.

Chemical and Allied Stocks and Shares

THERE has been increased business in stock markets with the beginning of the new account, although British Funds failed to hold all earlier gains. Industrial shares continued to attract attention on the pros-

pect of higher dividends opened up by the end of E.P.T. and moreover sentiment had the benefit of a number of further increased payments included in the latest batch of company announcements. Nevertheless, with few exceptions, a large proportion of profits continues to be placed to reserves, etc., which is only prudent in existing conditions.

Shares of chemical and allied companies have claimed more attention, Imperial Chemical showing firmness at the higher level of 51s. partly on the chairman's statement at the meeting that the question of splitting the £1 units into four units of 5s. each may be considered. Wednesday's big Monsanto Chemicals issue attracted widespread attention not only because of the details of this progressive business, but because the issue, by giving the British public a chance to acquire an interest in the equity capital, represents an interesting development in Anglo-American co-operation. The prospectus showed that profits, which averaged £421,000 over the past ten years, have risen steadily from £233,000 in 1937 to £837,000 in 1946. At the issue price of 21s. the 3¾ per cent redeemable cumulative preference shares yield £3 11s. 5d. per cent. and the ordinary shares, offered at 42s. 6d. are being favoured as having long-term investment merits.

B. Laporte have advanced to 101s. 3d. W. J. Bush were 95s., and Fisons were 65s. A big issue of preference shares is expected shortly from Ganatosan Trust. British Aluminium have moved up to 50s. 6d. Reckitts strengthened to £6 9/16, and there have been sharp fluctuations in British Xylonite, which at £13¼ were again substantially higher on balance, but touched £13¾ at one time before profit-taking developed. Current dividend estimates maintained interest in Glaxo Laboratories, which at £29¼ were little changed on balance.

A feature was a moderate rally in iron and steel shares, Guest Keen improving to 48s. 3d., United Steel to 24s. 10½d., Colvilles to 25s. 6d., while on higher dividend hopes, Allied Ironfounders moved up to 70s. The market remains hopeful that the Government may shortly make an official statement as to its nationalisation intentions and remove the considerable uncertainty which has developed as to which sections of the industry would be taken over in the event of nationalisation.

Textiles have been stimulated by the J. & P. Coats' dividend increase and development programme. Courtaulds at 54s. 9d. were active but failed to hold best levels. Calico Printers were 22s. 7½d., Bradford Dyers 23s. 9d., and Bleachers 13s. 3d. Aspro remained active on E.P.T. abolition factors, but at 56s. 3d. have reflected a good deal of profit-taking. Beechams deferred at 30s. also failed to hold best levels. Griffiths Hughes were 68s. 3d., Sangers 37s. 3d., Timothy Whites 56s. 6d., and Boots Drug 64s. British Glues & Chemicals 4s. ordinary held their rise to 20s. General Refractories were firm at 25s., with Borax Consolidated deferred higher at 62s., but Turner & Newall at 93s. 3d. lost a small part of a further rise. Paint shares continued prominent with Goodlass Wall good at 39s. 4½d. on higher dividend hopes. Oil shares attracted more attention with moderate gains in both Anglo-Iranian and Burmah Oil, while Canadian Eagle Oil changed hands up to close on 44s.

British Chemical Prices

Market Reports

WITH a certain amount of expansion in the home industrial demand and a steady flow of orders from overseas, the chemical market has been under pressure during the past week. The supply position for the majority of the potash and soda products has changed very little, and buyers in other sections of the market continue to be confronted with uncertain delivery dates. Quotations throughout are firm and changes, where they have occurred, have been to higher levels. The price of standard 28/30 per cent lithopone has been raised to £32 17s. 6d. per ton and antimony oxide to £162 10s. per ton for five ton lots. The controlled price for ground sulphur has been raised by 7s. 6d. per ton as from May 12. Conditions in the coal-tar products market remain tight with spot offers exceedingly scarce. Creosote oil is active and pitch supplies are readily absorbed.

MANCHESTER.—From the point of view of inquiries, both home and export buyers of heavy chemicals have been prominent on the Manchester market during the past week and a steady flow of additions to order-books has been reported. In some departments the supply position is steadily creeping back to what it was in the closing months of last year before production was seriously affected by the fuel shortage. The textile and allied trades are calling for steady deliveries and this is also reported with regard to the glass and other using industries. There has been little change on balance in the position of the tar products market, where prices are extremely firm all round and outputs, with an odd exception, are being fully absorbed.

GLASGOW.—In the Scottish chemical trade, during the past week business has been brisk particularly for bleaching power and all classes of insecticides. The supply position is returning to normal now that the dockers' strike is over. In the export market inquiries continue to be firm.

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Patents in the Chemical Industry

The following information is prepared from the Official Patents Journal. Printed copies of specifications accepted may be obtained from the Patent Office, Southampton Buildings, London, W.C.2., at 1s. each.

Complete Specifications Open to Public Inspection

Killing weeds.—American Chemical Paint Co. Aug. 17, 1944. 22508/45.

Metachrome dyeing procedure.—American Cyanamid Co. June 27, 1944. 7996/47.

Interpolymerisation products.—British Thomson-Houston Co., Ltd. April 11, 1942. 5287/43.

Dichlorovinyl ethers.—Ciba, Ltd. Oct. 19, 1945. 30159/46.

Magnesium.—Compagnie de Produits Chimiques et Electro-Metallurgiques Alias, Froges, & Camargue. Oct. 17, 1945. 29868/46.

Sulphur burners.—E.I. Du Pont de Nemours & Co. April 24, 1945. 12353/46.

Aqueous dispersions.—E.I. Du Pont de Nemours & Co. Oct. 17, 1945. 30759/46.

Storage or concentration of acetylenic hydrocarbons.—E.I. Du Pont de Nemours & Co. Oct. 18, 1945. 31061/46.

Plastic compositions containing glass fibres.—E.I. Du Pont de Nemours & Co. Oct. 19, 1945. 31062/46.

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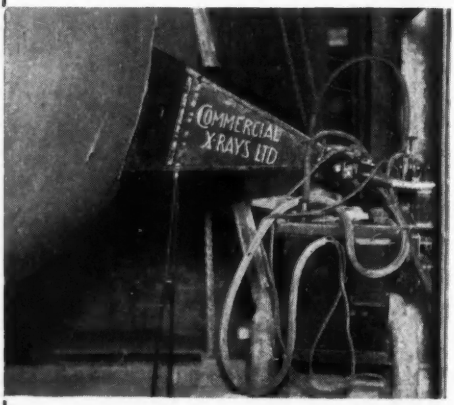

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